AMTEST
AIR QUALITY, LLC

AmTest-Air Quality, LLC
30545 S.E. 84th St., #5
Preston, WA 98050
Office: (206) 222-7746
FAX: (206) 222-7849

July 1, 1997

Mr. Gerald Brown
Ash Grove Cement Company
3801 E. Marginal Way
Seattle, Washington 98134

Dear Mr. Brown:

Please find enclosed one (1) copy of the final report Am Test-Air Quality, LLC has prepared for the source emission evaluation performed on March 25-27, 1997 at Ash Grove Cement Company's facility in Seattle, Washington. Please contact our office at (425) 222-7746 if you have any questions or require additional information.

Sincerely,
Am Test-Air Quality, LLC

Judy A. Aasland
Sr. Technical Writer

Enclosure
cc: Hans Steuch, Ash Grove Cement Company - Seattle, Washington
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SOURCE

EMISSION

EVALUATION

Draft Report Issued: May 2, 1997
Final Report Issued: June 30, 1997

Prepared For:

ASH GROVE CEMENT COMPANY
MAIN CEMENT KILN STACK
SEATTLE, WASHINGTON
MARCH 25-27, 1997

Submitted by:

Kris A. Hansen, QEP
President

Angela F. Blaisdell
Vice President

James A. Guenthoer
Sr. Project Engineer

Am Test-Air Quality, LLC
Preston, Washington

We certify that the information contained herein is accurate and complete to the best of our knowledge.

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1.0
INTRODUCTION

The purpose of this source emission evaluation was to quantify emissions from the main cement kiln stack at Ash Grove Cement Company's facility in Seattle, Washington. Ash Grove Cement Company in Portland, Oregon contracted Am Test-Air Quality, LLC based in Preston, Washington to perform these emissions tests at the Seattle facility on March 25-27, 1997. This testing was performed to provide data to assist Ash Grove Cement in making decisions on environmental issues.

The kiln stack gas was tested to quantify emissions of polychlorinated dibenzodioxins (PCDD), polychlorinated dibenzofurans (PCDF), and mercury (Hg). Three (3) runs of each type of test were performed during two (2) operating conditions identified as with the "roller mill on" (Condition #1) and with the "roller mill off" (Condition #2). During each run, the following were measured:

- gas temperature and velocity using Methods 1 and 2
- gas molecular weight (oxygen (O_2) and carbon dioxide (CO_2)) using Method 3A
- gas moisture content using Method 4
- dioxins/furans (PCDD/PCDF) using Method 23
- mercury (Hg) emissions using Method 101A

The methodology which was used to collect the emission samples is discussed in the July 1, 1996 edition of the EPA document Title 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Methods 1, 2, 3A, 4, and 23; and in the July 1, 1995 edition of 40 CFR 61, Appendix B, Method 101A.

EPA Methods 1 and 2 were performed to measure the stack gas velocity and temperature for calculating the volumetric flow rate. Method 3A was performed to determine the molecular weight of the gas based on percent (%) level measurements of oxygen (O_2) and carbon dioxide (CO_2) in the stack gas. Method 4 was performed to measure the moisture content of the gas. Method 23 was performed to quantify emissions of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) using a semi-volatile organic sample train (semi-VOST). Method 101A was performed to quantify emissions of mercury (Hg). Three (3) 180-minute Method 1, 2, 3A, 4 and 23 tests, and three (3) 120-minute Method 1, 2, 3A, 4, and 101A tests were performed simultaneously on March 25-26, 1997 at the kiln stack while the unit was operating with the roller mill on (Condition #1). Three (3) 180-minute Method 1, 2, 3A, 4 and 23 tests, and three (3) 120-minute Method 1, 2, 3A, 4, and 101A tests were performed simultaneously on March 27, 1997 at the kiln stack while the unit was operating with the roller mill off (Condition #2).

For this source test program, seven (7) locations were identified for the collection of process and fuel samples. These included coal, tire derived fuel (TDF), raw and kiln feed samples (before and after the roller mill), water spray, clinker, and cement kiln dust (CKD) samples. Mr. Patrick J. Noon of Ash Grove Cement collected these process and fuel samples and submitted them to Am Test, Inc.'s Water Chemistry Laboratory in Redmond, Washington for mercury analysis. A copy of the laboratory analysis report for the process and fuel samples is included in Appendix B of this report.

Mr. James A. Guenthoer, Mr. E. Ray Lawrence, Mr. Kevin P. Orton, and Mr. Paul J. Clark of Am Test-Air Quality, LLC conducted the field sampling. Am Test-Air Quality, LLC's laboratory and technical writing staff performed the sample recovery, laboratory analysis, data reduction, and quality assurance review. Alta Analytical

Laboratory Inc. in El Dorado Hills, California performed the PCDD/PCDF analyses. Am Test, Inc.'s Water Chemistry laboratory in Redmond, Washington performed the mercury analyses. Ms. Judy A. Aasland prepared the final report, and Ms. Angela F. Blaisdell and Mr. Kris A. Hansen performed the senior report review. Mr. Hans Steuch of Ash Grove Cement Company in Portland, Oregon and Mr. Craig Cape of Gossman Consulting, Inc. in Santa Clarita, California coordinated the test program.

2.0
SUMMARY OF RESULTS

The following subsections of this report present the results from the emissions tests performed on March 25-27, 1997 at the main cement kiln stack. Three (3) successful runs of each type of test were performed during two (2) operating conditions identified as roller mill on (Condition #1) and roller mill off (Condition #2). One set of tests (run 3) during Condition #1 had to be aborted because of process problems. The run was repeated and is identified as run 4. The order of presentation is as follows: Method 23 followed by Method 101A. Results for Condition #1 are presented before results for Condition #2. Summary tables are included in this section which present the data for each individual run, along with the average for each set of 3 runs. Refer to the Table of Contents to locate specific information for each test method. The summary tables in this section contain information obtained from computer printouts of results for each individual run which are included in Appendix A of this report. Appendix B of this report contains the laboratory analysis data. Appendix C of this report contains copies of Ash Grove's process data collected during the emissions tests. Appendix D of this report contains example calculations of results and copies of the original field data sheets. Appendix E of this report contains miscellaneous supporting information. Sampling deviations and/or process difficulties are discussed in Section 3.0 of this report titled "Project Overview/Exceptions."

2.1 EPA Method 23 - Dioxin/Furan (PCDD/PCDF) Emissions

Six (6) Method 1, 2, 3A, 4, and 23 tests were performed at the main cement kiln stack on March 25-27, 1997 for quantifying emissions of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF). Runs 1, 2, and 4 were performed with the roller mill on (Condition #1), and runs 5, 6, and 7 were performed with the roller mill off (Condition #2). Run 3 during Condition #1 was aborted due to process problems. Each test run was 180 minutes in duration. Method 23 uses a semi-volatile organic sample train (semi-VOST) to collect the compounds of interest. Results of these tests are summarized on the following computer printouts titled "Summary of Results - Methods 1, 2, 3A, 4, and 23," "Summary of Polychlorinated Dibenzodioxins and Dibenzofurans Emission Concentration Results," and "Summary of Polychlorinated Dibenzodioxins and Dibenzofurans Emission Rate Results."

The semi-VOST samples were submitted to Alta Analytical Laboratory Inc. for analysis. The sample extracts and toluene rinse were combined and analyzed using EPA Method 23. The samples were analyzed using high resolution mass spectrometry (HRMS). The laboratory analysis results were presented in units of picograms (pg) per sample and are included in Appendix B of this report. Alta Analytical's analysis report provides general comments and explains any anomalies associated with this project.

The PCDD/PCDF laboratory analysis results were reported in units of picograms (pg), and were then converted to emission concentration units of total nanograms (ng) per dry standard cubic meter (ng/m^3) uncorrected and corrected to seven percent oxygen (@ 7% O_2). The PCDD/PCDF results were also converted to emission rate units of milligrams per hour (mg/hr). The emission concentrations and emission rates for each individual run are presented on computer printouts in Appendix A of this report. The printouts for the individual runs include the field blank and detection limit values. Am

Test does not blank-correct PCDD/PCDF data, so the blank values and the detection limits should be compared to the test data.

It should be noted that if emission results from any portion of the sample are designated with a "U" (i.e. undetected), then that portion is counted as zero (0) in the total. Quantitation limits are based on the concentration of the lowest calibration standard, the volume of the final sample extract, and the amount of sample initially extracted. If all of the sample portions for a run are "U," then the detection limits are added together, and the total is designated with a "U." When the results for three (3) or more runs are averaged together, if a value was less than (<) the DL, it is counted as zero (0) in the average. If 1 or 2 values are < the DL and the average value is greater than (>) the DL, then it is presented as an approximation (~) in the average column. If the average value is < the average DL, then the average DL is presented in the average column designated with a "U." In cases where a compound is found in levels above the detection limit for only 1 or 2 runs, the data should be considered to be less significant than cases where a compound was found for all runs. The data becomes increasingly significant as the concentration value increases in orders of magnitude above the blank value or detection limit. The converse of this would be true as the concentration value approaches the detection limit. A factor of 5 times the DL or blank is typically used by analytical laboratories to determine the significance of a value. If the average presented on the summary table is less than 5 times the average DL for an analyte, the average is designated with a "B." Data that are identified with a "M" signify that the analyte was detected in the laboratory method blank.

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SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4, AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME: JAA\97-043WD\23SUM1
CLIENT: Ash Grove Cement Company
LOCATION: Seattle, Washington

	Roller Mill ON CEMENT KILN MAIN STACK			
	RUN #1	RUN #2	RUN #4	AVERAGE
LAB #:	1451	1452	1453	
DATE:	3/25/97	3/25/97	3/26/97	
START TIME:	0700	1117	1303	
STOP TIME:	1013	1435	1613	
SAMPLE LENGTH (minutes):	180.0	180.0	180.0	
VOLUME SAMPLED (cubic feet):	122.204	120.024	121.582	121.270
VOLUME SAMPLED (dry std. cubic feet):	120.687	118.201	120.817	79.629
VOLUME SAMPLED (dry std. cubic meters):	3.418	3.348	3.422	3.396
STACK GAS MOISTURE (percent):	12.06	12.82	11.15	12.01
BAROMETRIC PRESSURE (inches of Hg):	30.05	30.05	29.80	29.97
STATIC PRESSURE (inches of H2O):	-0.50	-0.50	-0.50	-0.50
STACK PRESSURE (inches of Hg):	30.01	30.01	29.76	29.93
STACK GAS TEMPERATURE (degrees F.):	226.9	221.8	232.8	227.2
STACK GAS TEMPERATURE (degrees R.):	686.9	681.8	692.8	687.2
CARBON DIOXIDE (percent):	18.7	18.1	19.8	18.9
OXYGEN (percent):	10.1	10.4	9.7	10.1
MOLECULAR WEIGHT (dry, g/g-mole):	31.40	31.31	31.56	31.42
MOLECULAR WEIGHT (wet, g/g-mole):	29.78	29.61	30.04	29.81
AVERAGE VELOCITY HEAD (inches of H2O):	0.150	0.144	0.146	0.147
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	24.4	23.8	24.1	24.1
STACK DIAMETER (inches):	156	156	156	
STACK AREA (square feet):	132.7	132.7	132.7	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	131543	128585	129390	129839
STACK GAS AIRFLOW (actual cubic feet per min.):	194005	189855	192106	191989
NOZZLE DIAMETER (inches):	0.356	0.356	0.356	
ISOKINETICS (percent):	98	98	100	

AMTEST AIR QUALITY, LLC

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4, AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME: JAA\97-043WD\23SUM2
CLIENT: Ash Grove Cement Company
LOCATION: Seattle, Washington

	Roller Mill OFF CEMENT KILN MAIN STACK			
	RUN #5	RUN #6	RUN #7	AVERAGE
LAB #:	1454	1455	1456	
DATE:	3/27/97	3/27/97	3/27/97	
START TIME:	0700	1045	1455	
STOP TIME:	1011	1356	1806	
SAMPLE LENGTH (minutes):	180.0	180.0	180.0	
VOLUME SAMPLED (cubic feet):	100.845	96.659	96.343	97.949
VOLUME SAMPLED (dry std. cubic feet):	101.408	96.614	95.617	97.880
VOLUME SAMPLED (dry std. cubic meters):	2.872	2.736	2.708	2.772
STACK GAS MOISTURE (percent):	9.13	9.65	9.43	9.40
BAROMETRIC PRESSURE (inches of Hg):	30.00	30.00	30.00	30.00
STATIC PRESSURE (inches of H2O):	-0.65	-0.65	-0.65	-0.65
STACK PRESSURE (inches of Hg):	29.95	29.95	29.95	29.95
STACK GAS TEMPERATURE (degrees F.):	398.2	423.5	428.3	416.7
STACK GAS TEMPERATURE (degrees R.):	858.2	883.5	888.3	876.7
CARBON DIOXIDE (percent):	22.9	23.4	24.6	23.6
OXYGEN (percent):	7.8	7.0	6.1	7.0
MOLECULAR WEIGHT (dry, g/g-mole):	31.98	32.02	32.18	32.06
MOLECULAR WEIGHT (wet, g/g-mole):	30.70	30.67	30.84	30.74
AVERAGE VELOCITY HEAD (inches of H2O):	0.111	0.108	0.106	0.108
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	23.1	23.2	22.9	23.1
STACK DIAMETER (inches):	156	156	156	
STACK AREA (square feet):	132.7	132.7	132.7	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	103104	99675	98400	100393
STACK GAS AIRFLOW (actual cubic feet per min.):	184208	184397	182574	183726
NOZZLE DIAMETER (inches):	0.356	0.356	0.356	
ISOKINETICS (percent):	105	103	104	

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SUMMARY OF POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS EMISSION CONCENTRATION RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\DF\DFSUM
Client: Ash Grove Cement Company
Location: Seattle, Washington

		MAIN CEMENT KILN STACK							
		ROLLER MILL ON				ROLLER MILL OFF			
		Run 1 3/25/97 0700 1013	Run 2 3/25/97 1117 1435	Run 4 3/26/97 1303 1613	AVERAGE Runs 1, 2, & 4	Run 5 3/27/97 0700 1011	Run 6 3/27/97 1045 1356	Run 7 3/27/97 1455 1806	AVERAGE Runs 5, 6, & 7
	Analyte	pg	pg	pg	pg	pg	pg	pg	pg
DIOXINS	2, 3, 7, 8-TCDD	3.3 U	2.8 U	1.9 U	2.7 U	14	22	26	21
	TCDDs (total)	7.5	22	5.6	12 B	3000	5100	5700	4600
	1, 2, 3, 7, 8-PeCDD	1.3 U	11	1.0 U	~ 3.7 B	20	36	45	34
	PeCDDs (total)	9.4	74	8.0	30	610	1700	2100	1470
	1, 2, 3, 4, 7, 8-HxCDD	2.0 U	23	1.5 U	~ 7.7 B	16	24	33	24
	1, 2, 3, 6, 7, 8-HxCDD	1.8 U	26	1.9 U	~ 8.7	18	22	30	23
	1, 2, 3, 7, 8, 9-HxCDD	1.7 U	31	1.3 U	~ 10	12	15	24	17
	HxCDDs (total)	14	290	14	106	530	790	960	760
	1,2,3,4,6,7,8-HpCDD	8.1	330	8.6	116	65	71	130	89
	HpCDDs (total)	15	590	15	207	140	150	270	187
	OCDD	58 M	2200 M	68 M	775	140 M	120 M	520 M	260
FURANS	2, 3, 7, 8-TCDF	2.2 U	6.3	2.4 U	~ 2.1 B	83	200	190	158
	TCDFs (total)	29	130	13	57	8100	20000	18000	15367
	1, 2, 3, 7, 8-PeCDF	1.3 U	19	1.7 U	~ 6.3 B	14	25	32	24
	2, 3, 4, 7, 8-PeCDF	1.3 U	31	1.6 U	~ 10 B	18	33	42	31
	PeCDFs (total)	1.6 U	300	1.7 U	~ 100	230	970	1000	733
	1, 2, 3, 4, 7, 8-HxCDF	2.1	87	0.83 U	~ 31	10	10	31	17
	1, 2, 3, 6, 7, 8-HxCDF	1.4 U	79	0.85 U	~ 26	6.5	7.7	27	14
	2, 3, 4, 6, 7, 8-HxCDF	2.3	180	1.3	61	8.7	9.4	48	22
	1, 2, 3, 7, 8, 9-HxCDF	1.0 U	34	1.0 U	~ 11	2.7	2.6	11	5.4
	HxCDFs (total)	7.8	880	3.3	297	66	91	290	149
	1, 2, 3, 4, 6, 7, 8-HpCDF	7.7	920	6.0	311	22	21	210	84
	1, 2, 3, 4, 7, 8, 9-HpCDF	1.0 U	100	0.68 U	~ 33	6.5	3.2	28	13
	HpCDFs (total)	7.7	1300	11	440	35	33	320	129
	OCDF	13	770	9.9	264	24	14	190	76
	Toxic Equivalent (TEQ)	0.67	85	0.35	29	50	88	96	78

pg = picograms per sample collected.
U = Undetected at specified detection limit (DL).
M = analyte detected in the method blank.
B = less than five times the detection limit.

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SUMMARY OF POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS EMISSION CONCENTRATION RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\DF\DFSUM
Client: Ash Grove Cement Company
Location: Seattle, Washington

		MAIN CEMENT KILN STACK							
		ROLLER MILL ON				ROLLER MILL OFF			
	Analyte	Run 1 3/25/97 0700 1013 ng/m³	Run 2 3/25/97 1117 1435 ng/m³	Run 4 3/26/97 1303 1613 ng/m³	AVERAGE Runs 1, 2, & 4 ng/m³	Run 5 3/27/97 0700 1011 ng/m³	Run 6 3/27/97 1045 1356 ng/m³	Run 7 3/27/97 1455 1806 ng/m³	AVERAGE Runs 5, 6, & 7 ng/m³
DIOXINS	2, 3, 7, 8-TCDD	0.001 U	0.001 U	0.001 U	0.001 U	0.005	0.008	0.010	0.008
	TCDDs (total)	0.002	0.007	0.002	0.003 B	1.04	1.86	2.10	1.67
	1, 2, 3, 7, 8-PeCDD	0.0004 U	0.003	0.0003 U	~ 0.001 B	0.007	0.013	0.017	0.012
	PeCDDs (total)	0.003	0.022	0.002	0.009	0.212	0.621	0.775	0.536
	1, 2, 3, 4, 7, 8-HxCDD	0.001 U	0.007	0.0004 U	~ 0.002 B	0.006	0.009	0.012	0.009
	1, 2, 3, 6, 7, 8-HxCDD	0.001 U	0.008	0.001 U	~ 0.003	0.006	0.008	0.011	0.008
	1, 2, 3, 7, 8, 9-HxCDD	0.0005 U	0.009	0.0004 U	~ 0.003	0.004	0.005	0.009	0.006
	HxCDDs (total)	0.004	0.087	0.004	0.032	0.185	0.289	0.355	0.276
	1,2,3,4,6,7,8-HpCDD	0.002	0.099	0.003	0.034	0.023	0.026	0.048	0.032
	HpCDDs (total)	0.004	0.176	0.004	0.062	0.049	0.055	0.100	0.068
	OCDD	0.017 M	0.657 M	0.020 M	0.231	0.049 M	0.044 M	0.192 M	0.095
FURANS	2, 3, 7, 8-TCDF	0.001 U	0.002	0.001 U	~ 0.001 B	0.029	0.073	0.070	0.057
	TCDFs (total)	0.008	0.039	0.004	0.017	2.82	7.31	6.65	5.59
	1, 2, 3, 7, 8-PeCDF	0.0004 U	0.006	0.0005 U	~ 0.002 B	0.005	0.009	0.012	0.009
	2, 3, 4, 7, 8-PeCDF	0.0004 U	0.009	0.0005 U	~ 0.003 B	0.006	0.012	0.016	0.011
	PeCDFs (total)	0.0005 U	0.090	0.0005 U	~ 0.030	0.080	0.355	0.369	0.268
	1, 2, 3, 4, 7, 8-HxCDF	0.001	0.026	0.0002 U	~ 0.009	0.003	0.004	0.011	0.006
	1, 2, 3, 6, 7, 8-HxCDF	0.0004 U	0.024	0.0002 U	~ 0.008	0.002	0.003	0.010	0.005
	2, 3, 4, 6, 7, 8-HxCDF	0.001	0.054	0.0004	0.018	0.003	0.003	0.018	0.008
	1, 2, 3, 7, 8, 9-HxCDF	0.0003 U	0.010	0.0003 U	~ 0.003	0.001	0.001	0.004	0.002
	HxCDFs (total)	0.002	0.263	0.001	0.089	0.023	0.033	0.107	0.054
	1, 2, 3, 4, 6, 7, 8-HpCDF	0.002	0.275	0.002	0.093	0.008	0.008	0.078	0.031
	1, 2, 3, 4, 7, 8, 9-HpCDF	0.0003 U	0.030	0.0002 U	~ 0.010	0.002	0.001	0.010	0.005
	HpCDFs (total)	0.002	0.388	0.003	0.131	0.012	0.012	0.118	0.047
	OCDF	0.004	0.230	0.003	0.079	0.008	0.005	0.070	0.028
	Toxic Equivalent (TEQ)	0.0002	0.025	0.0001	0.009	0.017	0.032	0.035	0.028

ng/m³ = nanograms of analyte emitted per dry standard cubic meter of gas sampled.
U = Undetected at specified detection limit (DL).
M = analyte detected in the method blank
B = less than five times the detection limit

S300557

AGCS2M003142

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SUMMARY OF POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS EMISSION CONCENTRATION RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\DF\DFSUM
Client: Ash Grove Cement Company
Location: Seattle, Washington

MAIN CEMENT KILN STACK

		ROLLER MILL ON				ROLLER MILL OFF			
		Run 1 3/25/97 0700 1013	Run 2 3/25/97 1117 1435	Run 4 3/26/97 1303 1613	AVERAGE Runs 1, 2, & 4	Run 5 3/27/97 0700 1011	Run 6 3/27/97 1045 1356	Run 7 3/27/97 1455 1806	AVERAGE Runs 5, 6, & 7
	Analyte	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2	ng/m³ @ 7% O_2
DIOXINS	2, 3, 7, 8-TCDD	0.001 U	0.001 U	0.001 U	0.001 U	0.005	0.008	0.009	0.007
	TCDDs (total)	0.003	0.009	0.002	0.005 B	1.11	1.86	1.98	1.65
	1, 2, 3, 7, 8-PeCDD	0.000 U	0.004	0.0004 U	~ 0.001 B	0.007	0.013	0.016	0.012
	PeCDDs (total)	0.004	0.029	0.003	0.012	0.225	0.621	0.728	0.525
	1, 2, 3, 4, 7, 8-HxCDD	0.001 U	0.009	0.001 U	~ 0.003 B	0.006	0.009	0.011	0.009
	1, 2, 3, 6, 7, 8-HxCDD	0.001 U	0.010	0.001 U	~ 0.003	0.007	0.008	0.010	0.008
	1, 2, 3, 7, 8, 9-HxCDD	0.001 U	0.012	0.0005 U	~ 0.004	0.004	0.005	0.008	0.006
	HxCDDs (total)	0.005	0.115	0.005	0.042	0.196	0.289	0.333	0.273
	1,2,3,4,6,7,8-HpCDD	0.003	0.130	0.003	0.046	0.024	0.026	0.045	0.032
	HpCDDs (total)	0.006	0.233	0.005	0.081	0.052	0.055	0.094	0.067
	OCDD	0.022 M	0.870 M	0.025 M	0.305	0.052 M	0.044 M	0.180 M	0.092
FURANS	2, 3, 7, 8-TCDF	0.001 U	0.002	0.001 U	~ 0.001 B	0.031	0.073	0.066	0.057
	TCDFs (total)	0.011	0.051	0.005	0.022	2.99	7.31	6.24	5.52
	1, 2, 3, 7, 8-PeCDF	0.0005 U	0.008	0.001 U	~ 0.003 B	0.005	0.009	0.011	0.008
	2, 3, 4, 7, 8-PeCDF	0.0005 U	0.012	0.001 U	~ 0.004 B	0.007	0.012	0.015	0.011
	PeCDFs (total)	0.001 U	0.119	0.001 U	~ 0.040	0.085	0.355	0.347	0.262
	1, 2, 3, 4, 7, 8-HxCDF	0.001	0.034	0.0003 U	~ 0.012	0.004	0.004	0.011	0.006
	1, 2, 3, 6, 7, 8-HxCDF	0.001 U	0.031	0.0003 U	~ 0.010	0.002	0.003	0.009	0.005
	2, 3, 4, 6, 7, 8-HxCDF	0.001	0.071	0.0005	0.024	0.003	0.003	0.017	0.008
	1, 2, 3, 7, 8, 9-HxCDF	0.0004 U	0.013	0.0004 U	~ 0.004	0.001	0.001	0.004	0.002
	HxCDFs (total)	0.003	0.348	0.001	0.117	0.024	0.033	0.101	0.053
	1, 2, 3, 4, 6, 7, 8-HpCDF	0.003	0.364	0.002	0.123	0.008	0.008	0.073	0.030
	1, 2, 3, 4, 7, 8, 9-HpCDF	0.0004 U	0.040	0.0002 U	~ 0.013	0.002	0.001	0.010	0.004
	HpCDFs (total)	0.003	0.514	0.004	0.174	0.013	0.012	0.111	0.045
	OCDF	0.005	0.304	0.004	0.104	0.009	0.005	0.066	0.027
	Toxic Equivalent (TEQ)	0.0003	0.034	0.0001	0.011	0.018	0.032	0.033	0.028

ng/m³ @ 7% O_2 = nanograms of analyte emitted per dry standard cubic meter of gas sampled, corrected to 7% oxygen M = analyte detected in the method blank
U = Undetected at specified detection limit (DL). B = less than five times the detection limit.

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AMTEST
AIR QUALITY, LLC

SUMMARY OF POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS EMISSION RATE RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\DF\DFSUM
Client: Ash Grove Cement Company
Location: Seattle, Washington

		MAIN CEMENT KILN STACK							
		ROLLER MILL ON				ROLLER MILL OFF			
	Analyte	Run 1 3/25/97 0700 1013 mg/hr	Run 2 3/25/97 1117 1435 mg/hr	Run 4 3/26/97 1303 1613 mg/hr	AVERAGE Runs 1, 2, & 4 mg/hr	Run 5 3/27/97 0700 1011 mg/hr	Run 6 3/27/97 1045 1356 mg/hr	Run 7 3/27/97 1455 1806 mg/hr	AVERAGE Runs 5, 6, & 7 mg/hr
DIOXINS	2, 3, 7, 8-TCDD	0.216 U	0.183 U	0.122 U	0.174 U	0.854	1.36	1.61	1.27
	TCDDs (total)	0.490	1.44	0.360	0.762 B	183.0	315.7	351.9	283.6
	1, 2, 3, 7, 8-PeCDD	0.085 U	0.718	0.064 U	~ 0.239 B	1.22	2.23	2.78	2.08
	PeCDDs (total)	0.615	4.83	0.514	1.99	37.2	105.2	129.7	90.70
	1, 2, 3, 4, 7, 8-HxCDD	0.131 U	1.50	0.096 U	~ 0.500 B	0.98	1.49	2.04	1.50
	1, 2, 3, 6, 7, 8-HxCDD	0.118 U	1.70	0.122 U	~ 0.566	1.10	1.36	1.85	1.44
	1, 2, 3, 7, 8, 9-HxCDD	0.111 U	2.02	0.084 U	~ 0.674	0.732	0.929	1.48	1.05
	HxCDDs (total)	0.916	18.9	0.900	6.91	32.3	48.9	59.3	46.8
	1,2,3,4,6,7,8-HpCDD	0.530	21.5	0.553	7.54	3.97	4.40	8.03	5.46
	HpCDDs (total)	0.981	38.5	0.964	13.5	8.54	9.29	16.7	11.5
	OCDD	3.79 M	143.6 M	4.37 M	50.6	8.54 M	7.43 M	32.1 M	16.0
FURANS	2, 3, 7, 8-TCDF	0.144 U	0.411	0.154 U	~ 0.137 B	5.06	12.4	11.7	9.73
	TCDFs (total)	1.90	8.48	0.835	3.74	494.1	1238	1111	947.9
	1, 2, 3, 7, 8-PeCDF	0.085 U	1.24	0.109 U	~ 0.413 B	0.854	1.55	1.98	1.46
	2, 3, 4, 7, 8-PeCDF	0.085 U	2.02	0.103 U	~ 0.674 B	1.10	2.04	2.59	1.91
	PeCDFs (total)	0.105 U	19.6	0.109 U	~ 6.53	14.0	60.0	61.7	45.27
	1, 2, 3, 4, 7, 8-HxCDF	0.137	5.68	0.053 U	~ 2.03	0.604	0.619	1.91	1.05
	1, 2, 3, 6, 7, 8-HxCDF	0.092 U	5.16	0.055 U	~ 1.72	0.397	0.477	1.67	0.847
	2, 3, 4, 6, 7, 8-HxCDF	0.150	11.7	0.084	3.99	0.531	0.582	2.96	1.36
	1, 2, 3, 7, 8, 9-HxCDF	0.065 U	2.22	0.064 U	~ 0.740	0.165	0.161	0.679	0.335
	HxCDFs (total)	0.510	57.4	0.212	19.4	4.03	5.63	17.9	9.19
	1, 2, 3, 4, 6, 7, 8-HpCDF	0.504	60.0	0.386	20.3	1.34	1.30	13.0	5.20
	1, 2, 3, 4, 7, 8, 9-HpCDF	0.065 U	6.53	0.044 U	~ 2.18	0.397	0.198	1.73	0.774
	HpCDFs (total)	0.504	84.8	0.707	28.7	2.14	2.04	19.8	7.98
	OCDF	0.850	50.3	0.636	17.2	1.46	0.867	11.7	4.69
	Toxic Equivalent (TEQ)	0.044	5.55	0.022	1.87	3.05	5.45	5.93	4.81

mg/hr = milligrams of analyte collected per hour.
U = Undetected at specified detection limit (DL).
M = analyte detected in the method blank
B = less than five times the detection limit.

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2.2 Method 101A - Mercury (Hg) Emissions

Six (6) Method 1, 2, 3A, 4, and 101A tests were performed at the main cement kiln stack on March 25-27, 1997 for quantifying mercury (Hg) emissions. Runs 1, 2, and 4 were performed with the roller mill on (Condition #1), and runs 5, 6, and 7 were performed with the roller mill off (Condition #2). Run 3 during Condition #1 was aborted due to process problems. Each test run was 120 minutes in duration. The results of these tests are summarized on the following computer printouts titled "Summary of Results - Methods 1, 2, 3A, 4, and 101A," and "Summary of Mercury Emissions Results."

The samples were submitted to Am Test, Inc.'s Trace Metals laboratory for mercury analysis using EPA Method 245.1, which is a cold vapor atomic absorption (CVAA) spectroscopy technique for measuring low levels of mercury (Hg). The laboratory analysis data are included in Appendix B of this report in units of micrograms (*ug*) of metal per sample.

The mercury laboratory analysis results were converted to emission concentration units of nanograms per dry standard cubic meter (ng/m^3) uncorrected and corrected to seven percent oxygen (@ 7% O_2). The mercury results were also calculated in units of milligrams per hour (mg/hr). The metals emission concentration and emission rate results compared to their detection limits are presented on computer printouts titled "Metals Emission Concentration Results" and "Metals Emission Rate Results," which are included in Appendix A of this report. Detection limits are different for each run, so they must be compared with the printouts in Appendix A of this report. Computer printouts with the reagent blank and field blank emission concentrations and emission rates are also included in Appendix A of this report. Am Test did not blank-correct the

metals emissions data, so the blank values and the detection limits should be compared to the test data.

It should be noted that the results designated with a "U" were undetected at the given detection limit (DL). When the results for three (3) or more runs are averaged together, if a value is less than (<) the DL, it is counted as zero (0) in the average. If 1 or 2 values are < the DL and the average value is greater than (>) the DL, then it is presented as an approximation (~) in the average column. If the average value is < the average DL, then the average DL is presented in the average column designated with a "U." In cases where a compound is found in levels above the detection limit for only 1 or 2 runs, the data should be considered to be less significant than cases where a compound was found for all runs. The data becomes increasingly significant as the concentration value increases in orders of magnitude above the blank value or detection limit. The converse of this would be true as the concentration value approaches the detection limit. A factor of 5 times the DL or blank is typically used by analytical laboratories to determine the significance of a value. If the average presented on the summary table is less than 5 times the average DL for an analyte, the average is designated with a "B."

AMTEST
AIR QUALITY, LLC

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4, AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME: JAA\97-043WD\101ASUM
CLIENT: Ash Grove Cement Company
LOCATION: Seattle, Washington

	Roller Mill ON CEMENT KILN MAIN STACK			
	RUN #1	RUN #2	RUN #4	AVERAGE
LAB #:	1457	1458	1459	
DATE:	3/25/97	3/25/97	3/26/97	
START TIME:	0700	1045	1313	
STOP TIME:	0910	1327	1554	
SAMPLE LENGTH (minutes):	120.0	120.0	120.0	
VOLUME SAMPLED (cubic feet):	84.769	82.743	82.026	83.179
VOLUME SAMPLED (dry std. cubic feet):	84.786	80.757	80.741	82.095
VOLUME SAMPLED (dry std. cubic meters):	2.401	2.287	2.287	2.325
STACK GAS MOISTURE (percent):	12.00	12.99	11.67	12.22
BAROMETRIC PRESSURE (inches of Hg):	30.05	30.05	29.80	29.97
STATIC PRESSURE (inches of H2O):	-0.50	-0.48	-0.46	-0.48
STACK PRESSURE (inches of Hg):	30.01	30.01	29.77	29.93
STACK GAS TEMPERATURE (degrees F.):	228.9	225.5	232.3	228.9
STACK GAS TEMPERATURE (degrees R.):	688.9	685.5	692.3	688.9
CARBON DIOXIDE (percent):	18.7	18.1	19.8	18.9
OXYGEN (percent):	10.1	10.3	9.7	10.0
MOLECULAR WEIGHT (dry, g/g-mole):	31.40	31.31	31.56	31.42
MOLECULAR WEIGHT (wet, g/g-mole):	29.79	29.58	29.97	29.78
AVERAGE VELOCITY HEAD (inches of H2O):	0.170	0.154	0.156	0.160
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	26.0	24.7	25.0	25.2
STACK DIAMETER (inches):	156	156	156	
STACK AREA (square feet):	132.7	132.7	132.7	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	140070	132425	133221	135239
STACK GAS AIRFLOW (actual cubic feet per min.):	207044	196960	198768	200924
NOZZLE DIAMETER (inches):	0.353	0.353	0.353	
ISOKINETICS (percent):	99	99	99	

AMTEST
AIR QUALITY, LLC

SUMMARY OF MERCURY EMISSIONS RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\HG\HGSM
Client: Ash Grove Cement Plant
Location: Seattle, Washington
Sample Site: Cement Kiln Main Stack
Condition: **Roller Mill ON**

EMISSION CONCENTRATION

Analyte		Run 1 3/25/97 0700 0910 µg	Run 2 3/25/97 1045 1327 µg	Run 4 3/26/97 1313 1554 µg	AVERAGE µg	Field Blank µg
Mercury	Hg	40	41	38	39.7	0.91

EMISSION CONCENTRATION

Analyte		Run 1 3/25/97 0700 0910 ng/dscm	Run 2 3/25/97 1045 1327 ng/dscm	Run 4 3/26/97 1313 1554 ng/dscm	AVERAGE ng/dscm	Field Blank ng/dscm
Mercury	Hg	16660	17927	16616	17068	391.4

EMISSION CONCENTRATION

Analyte		Run 1 3/25/97 0700 0910 ng/dscm @ 7% O_2	Run 2 3/25/97 1045 1327 ng/dscm @ 7% O_2	Run 4 3/26/97 1313 1554 ng/dscm @ 7% O_2	AVERAGE ng/dscm @ 7% O_2	Field Blank ng/dscm @ 7% O_2
Mercury	Hg	21442	23509	20621	21857	500.7

EMISSION RATE

Analyte		Run 1 3/25/97 0700 0910 mg/hr	Run 2 3/25/97 1045 1327 mg/hr	Run 4 3/26/97 1313 1554 mg/hr	AVERAGE mg/hr	Field Blank mg/hr
Mercury	Hg	3965	4034	3761	3920	89.9

U = Not detected at specified reporting limits.
B = Less than five times the detection limit.
ug = micrograms
ng/dscm = nanograms of analyte per dry standard cubic meter.
ng/dscm @ 7% O_2 = nanograms of analyte per dry standard cubic meter, corrected to 7% oxygen.
mg/hr = milligrams of analyte emitted per hour.

AMTEST
AIR QUALITY, LLC

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4, AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME: JAA\97-043WD\101ASUM2
CLIENT: Ash Grove Cement Company
LOCATION: Seattle, Washington

Roller Mill OFF
CEMENT KILN MAIN STACK

	RUN #5	RUN #6	RUN #7	AVERAGE
LAB #:	1460	1461	1462	
DATE:	3/27/97	3/27/97	3/27/97	
START TIME:	0700	1045	1450	
STOP TIME:	0923	1259	1710	
SAMPLE LENGTH (minutes):	120.0	120.0	120.0	
VOLUME SAMPLED (cubic feet):	66.537	65.472	66.248	66.086
VOLUME SAMPLED (dry std. cubic feet):	66.731	65.025	65.299	65.685
VOLUME SAMPLED (dry std. cubic meters):	1.890	1.842	1.849	1.860
STACK GAS MOISTURE (percent):	9.35	9.48	9.80	9.54
BAROMETRIC PRESSURE (inches of Hg):	30.00	30.00	30.00	30.00
STATIC PRESSURE (inches of H2O):	-0.65	-0.65	-0.65	-0.65
STACK PRESSURE (inches of Hg):	29.95	29.95	29.95	29.95
STACK GAS TEMPERATURE (degrees F.):	395.8	424.8	431.3	417.3
STACK GAS TEMPERATURE (degrees R.):	855.8	884.8	891.3	877.3
CARBON DIOXIDE (percent):	22.5	21.3	24.8	22.9
OXYGEN (percent):	8.1	7.3	6.0	7.1
MOLECULAR WEIGHT (dry, g/g-mole):	31.92	31.70	32.21	31.94
MOLECULAR WEIGHT (wet, g/g-mole):	30.62	30.40	30.82	30.61
AVERAGE VELOCITY HEAD (inches of H2O):	0.115	0.116	0.111	0.114
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	23.5	24.1	23.6	23.7
STACK DIAMETER (inches):	156	156	156	
STACK AREA (square feet):	132.7	132.7	132.7	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	104923	103890	100325	103046
STACK GAS AIRFLOW (actual cubic feet per min.):	187399	192105	187564	189023
NOZZLE DIAMETER (inches):	0.353	0.353	0.353	
ISOKINETICS (percent):	104	102	106	

AMTEST
AIR QUALITY, LLC

SUMMARY OF MERCURY EMISSIONS RESULTS
AM TEST - AIR QUALITY, LLC

File Name: JAA\97-043WD\HG\HGSM
Client: Ash Grove Cement Plant
Location: Seattle, Washington
Sample Site: Cement Kiln Main Stack
Condition: **Roller Mill OFF**

EMISSION CONCENTRATION

Analyte		Run 5 3/27/97 0700 0923 µg	Run 6 3/27/97 1045 1259 µg	Run 7 3/27/97 1450 1710 µg	AVERAGE µg	Field Blank µg
Mercury	Hg	1500	1500	1500	1500	0.91

EMISSION CONCENTRATION

Analyte		Run 5 3/27/97 0700 0923 ng/dscm	Run 6 3/27/97 1045 1259 ng/dscm	Run 7 3/27/97 1450 1710 ng/dscm	AVERAGE ng/dscm	Field Blank ng/dscm
Mercury	Hg	793651	814332	811249	806411	489.2

EMISSION CONCENTRATION

Analyte		Run 5 3/27/97 0700 0923 ng/dscm @ 7% O_2	Run 6 3/27/97 1045 1259 ng/dscm @ 7% O_2	Run 7 3/27/97 1450 1710 ng/dscm @ 7% O_2	AVERAGE ng/dscm @ 7% O_2	Field Blank ng/dscm @ 7% O_2
Mercury	Hg	861855	832295	756803	816984	493.9

EMISSION RATE

Analyte		Run 5 3/27/97 0700 0923 mg/hr	Run 6 3/27/97 1045 1259 mg/hr	Run 7 3/27/97 1450 1710 mg/hr	AVERAGE mg/hr	Field Blank mg/hr
Mercury	Hg	141499	143757	138298	141185	85.7

U = Not detected at specified reporting limits.
B = Less than five times the detection limit.
ug = micrograms
ng/dscm = nanograms of analyte per dry standard cubic meter.
ng/dscm @ 7% O_2 = nanograms of analyte per dry standard cubic meter, corrected to 7% oxygen.
mg/hr = milligrams of analyte emitted per hour.

3.0
PROJECT OVERVIEW/EXCEPTIONS

Sections 8.0 and 9.0 have been provided by Gossman Consulting, Inc. for inclusion into this report.

3.1 Acceptable Leak Checks and Percent Isokinetics

An acceptable leak check of less than 0.02 cubic feet per minute (cfm) at the highest vacuum rate (or greater) used during the test preceded and followed each Method 101A and Method 23 test. However, in two (2) cases, the final leak check flow and vacuum were not recorded. For these two (2) runs, the testers confirmed that the final leak checks were within specifications. The average percentage isokinetics for each Method 101A and Method 23 test were within the acceptable limits of 100 $\pm$ 10%.

3.2 Method 101A Sample Train Modification

Due to low particulate matter emissions in the stack gas, the Method 101A sample train was modified to exclude the filter which subsequently lowered the detection limits of the mercury results.

3.3 Process Upsets

During run 2 of the Method 23 and 101A testing, there were process upsets which continued into run 3 where the cyclone in the roller mill finally became plugged and the roller mill was shutdown. Run 3 run was aborted since the process was not able to be restarted within a reasonable time. A third run, identified as run 4, was performed on a separate test day (March 26, 1997). The three (3) test runs for Condition #1 (roller mill on) are identified as runs 1, 2, and 4; and the three (3) test runs for Condition #2 (roller mill off) are identified as runs 5, 6, and 7. The PCDD/PCDF emissions data for run 2 are significantly higher than runs 1 and 4.

3.4 PCDD/PCDF Detection Limits

Detection limits for detected dioxin/furan compounds could not be calculated by the subcontract laboratory, Alta Analytical Laboratory, due to signal noise interference from the instruments. Therefore, for detected dioxin/furan compounds, the method blank detection limits were used to compare to the sample concentrations. In some cases where the method blank detection limits were unavailable or were higher than the analyte detected in the sample, an estimated detection limit was used. These estimated detection limits are marked with an "E" on the individual computer printouts which are located in Appendix A of this report.

3.5 PCDD/PCDF Field Blank and Trip Blank Results

The PCDD/PCDF field blank appears to indicate that contamination occurred somewhere in the field blank process. Because all of the PCDD/PCDF sample portions are combined into one (1) sample, Am Test cannot ascertain where the contamination may be have occurred. To be fairly certain that the contamination did not occur in the XAD traps prepared by Alta Analytical Laboratory, the trip blank was also analyzed. With the exception of the OCDD analyte, the trip blank yielded no evidence of contamination. Upon reviewing the PCDD/PCDF emissions results for each of the two (2) test conditions, it appears that with the exception of run 2, which is discussed above, the sample results are consistent within each condition. The sample train used for the field blank was originally intended to have been used for run 1. The train was set-up, leak checked according to normal procedures, and prepared for sampling. Ash Grove requested a delay before commencing the test, and the sample train sat at the sample site for several hours before the final decision was made to not start the test program until the following day. Am Test felt that this train could not be reused for sampling on the next test day, therefore, a decision was made to recover the train as a field blank since it met the field blank test protocol. The train was leak checked again

and recovered using normal procedures. It is likely that the sample contamination in the field blank is limited to this sample and does not appear to affect the accuracy of the other samples.

3.6 Test Protocol Modification - Leak Checks/O_2 Measurements

Section 10 of the Hazardous Air Pollutants Test Protocol prepared for Ash Grove by Gossman Consulting, Inc., requested that a leak check of the sample train be performed before and after any move from one sampling port to another. Rather than perform multiple leak checks and introduce excess ambient air to the sample trains, Am Test elected to operate the O_2 and CO_2 analyzers continuously at the exhaust of the dry gas meter boxes to check the sample gas for ambient air leakage and to manually record percent (%) O_2 and CO_2 combustion gas data at each traverse point. The pre-test and post-test leak checks performed were acceptable and no adjustments to the glassware were necessary between test ports. No indication of leakage was apparent using the O_2 leak check procedures.

4.0
SOURCE DESCRIPTION/PROCESS DATA

4.1 Source Description

Ash Grove Cement Company's Portland cement plant located in Seattle, Washington was rebuilt in 1992. The plant consists of a kiln and mills capable of producing 750,000 tons of cement per year. The cement kiln is a five stage preheater/precalciner kiln. The kiln is 220 feet long and 15 feet in diameter. During normal operation, the kiln operates at about three revolutions per minute. The average residence time for a load of processed materials is approximately one-half hour. A pulverized coal, or natural gas fuel is introduced at the hot (low) end of the kiln, along with combustion air. Pulverized coal and tire derived fuel (TDF) are introduced in the preheater/precalciner. Kiln feed is introduced into the riser to the top stage of the preheater/precalciner. Kiln exhaust gases are ducted through the preheater/precalciner to the baghouse. Some kiln exhaust gases are diverted from the duct upstream of the baghouse and are pulled through the roller mill. The exhaust gases then exit the roller mill and are ducted back to the baghouse. From the baghouse, the exhaust gases enter the main stack. Operational parameters are monitored 24 hours per day in the Control Room.

The raw materials include limestone, silica sands, and an iron source, which are proportioned according to their chemistry to produce the proper raw mix. The mixed materials are reduced to 1-1/2 inch or less in size and are milled to a powder before entering the kiln systems' preheating tower. The feed passes through several stages in the preheater before it reaches the kiln, where high temperature chemical reactions change the feed into Portland cement clinker. The clinker, along with 5% gypsum addition, is ground in the finish mills. The cement is stored in silos for bulk shipments. Gases from the kiln system normally pass through the raw material roller mill for drying before

exhausting to the baghouse and main stack. When the roller mill is in operation, stack gas temperatures are about 200 degrees Fahrenheit (°F), which is considered normal operating mode (Condition #1). Five to ten percent of the kiln operating time, the roller mill is stopped (Condition #2). The scrubbing and cooling of kiln gases that normally takes place in the mill stops and the stack gas temperature increases to about 400 °F.

Ash Grove conducted these emissions tests to compare dioxin/furan and mercury emissions during normal operation when the roller mill is operating at stable conditions (Condition #1) and during the first 8-12 hours after the roller mill stops (Condition #2). Three (3) 120-minute Method 1, 2, 3A, 4 and 101A tests, and three (3) 180-minute Method 1, 2, 3A, 4, and 23 tests were performed simultaneously on March 25-26, 1997 at the kiln stack while the unit was operating with the raw mill on (Condition #1). Three (3) 120-minute Method 1, 2, 3A, 4 and 101A tests, and three (3) 180-minute Method 1, 2, 3A, 4, and 23 tests were performed simultaneously on March 27, 1997 at the kiln stack while the unit was operating with the raw mill off (Condition #2).

4.2 Process Data

Production data recorded on the days of testing were provided by Ash Grove personnel are included in Appendix C of this report.

4.3 Process and Fuel Sample Collection

For this source test program, seven (7) locations were identified for the collection of process and fuel samples. These included coal, tire derived fuel (TDF), raw and kiln feed samples (before and after the roller mill), water spray, clinker, and cement kiln dust (CKD) samples. Referenced below are detailed descriptions of the sampling location for each sample. Additional information regarding the process sampling methods is included

in Section 6 of the Hazardous Air Pollutants Test Protocol prepared for Ash Grove by Gossman Consulting, Inc.

Coal:	The sampling point is located at the coal belt before the coal mill.
Tire Derived Fuel (TDF):	The sampling point is located at the tire conveyor entrance to the precalciner.
Raw Feed:	The sampling point is located at the conveyor entrance to the roller mill.
Kiln Feed:	The sampling point is located on the air slide just at the kiln feed calibration bin.
Water:	From the mill spray line in the hydraulic room.
Clinker:	From the discharge of the clinker cooler.
Cement Kiln Dust: (recycled)	The sampling point is located on the baghouse return screw.

Mr. Patrick Noon of Ash Grove Cement collected the process and fuel samples and submitted them to Am Test, Inc.'s Water Chemistry Laboratory in Redmond, Washington for mercury analysis. A copy of the laboratory analysis report is included in Appendix B of this report.

5.0
SAMPLING AND ANALYSIS PROCEDURES

5.1 EPA Methods 1 and 2 - Velocity, Temperature, and Airflow

EPA Method 1 procedures were used to assure that representative measurements of volumetric flow rate were obtained by dividing the cross-section of the stack or duct into a number of equal areas, and then locating a traverse point within each of the equal areas. Refer to the "Stack Schematic and Location of Sample Points" data sheet and/or the figure titled, "Location of Sampling Ports and Traverse Points," located in the appendices of this report, for a schematic of the stack and the point locations selected for testing. Method 2 was performed to measure the stack gas velocity using a type S or a standard pitot tube, and the gas temperature using a calibrated thermocouple probe connected to a digital thermocouple indicator. The type S pitot tubes were connected with tubing to a pressure measurement device such as an oil-filled inclined manometer, magnehelic gauges, or a Shortridge® Instruments, Inc. The pitot tube lines were leak-checked and the pressure measurement device was leveled and zeroed prior to use. Calibration information for each pressure and temperature measurement device used are included in the appendices of this report.

5.2 EPA Method 3A - Molecular Weight

The stack gas composition was determined using EPA Method 3A procedures, which allow the use of instrumental analyzers. A paramagnetic analyzer was used to measure the percent (%) oxygen (O_2) and a non-dispersive infrared (NDIR) analyzer was used to measure the % carbon dioxide (CO_2). The analyzers continuously sampled a slipstream of the gas exiting the Method 23 and Method 101A sampling trains. During each isokinetic test period, % O_2 and CO_2 concentrations were manually recorded once per traverse point and averaged. The manufacturer and model number for the specific

analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. Certified O_2 and CO_2 gases were utilized to calibrate the instruments prior to use. Included in the appendices are specifications for the analyzers used along with copies of the certificates of analysis for the calibration gases used. The O_2 and CO_2 data were used to calculate the molecular weight of the stack gas.

5.3 EPA Method 4 - Moisture

Before and after each run, the impingers in the Method 23 and Method 101A sample trains were removed and weighed with a readability of 0.1 grams using an electronic top loading balance. The difference between the initial and final weights of the condenser section constitute the amount of moisture gained during the run.

5.4 EPA Method 23 - Dioxins/Furans (PCDD/PCDF)

Emissions of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) were quantified by collecting and analyzing semi-volatile organic sample train (semi-VOST) samples per Method 23 from 40 CFR 60. The procedures detailed in Chapter 8, Section 3.1.10 of the Portland Cement Association's 1995 Air Toxics Stack Testing Workshop Manual were also followed. Samples were collected over three (3) hour sample periods to assure adequate detection limits. The Method 23 sampling train is illustrated in the figure titled "Semi-Volatile Organic Compounds Sample Train" in the appendices of this report. Particulate phase organics are collected in the probe rinse and on an ultrapure dichloromethane (DCM) extracted quartz filter, and vapor phase organics are adsorbed on XAD-2 sorbent which is packed in specially designed modules and the filters. The contract laboratory prepared the sorbent modules. After sampling, each portion of the train was recovered and extracted, then the extracts were combined and concentrated for analysis. Method 23 specifies that a separate analysis of the toluene rinse be performed. For this test

program, the separate analysis of the toluene rinse was not performed as it is typically no longer required by the EPA, and the additional analysis is expensive. The combined extract was analyzed using SW-846 EPA Method 8290x for PCDD/PCDF using a combination of high resolution gas chromatography with high resolution mass spectroscopy (HRGC/HRMS). The results were presented in units of total picograms (pg) per sample. Results were converted to emission concentrations and emission rates.

Prior to arriving at the job site, all sample train components from the first impinger forward were rigorously cleaned to avoid organic contamination. Am Test does not use silicon grease with the glassware which is utilized in these sample trains, which helps reduce the chances of contamination from previous use. All glassware and sample train components were washed with non-ionic detergent and hot water, rinsed thoroughly with hot tap water, rinsed several times with deionized water, rinsed with acetone, rinsed with methylene chloride, and then baked for 2 hours at 350° F. All openings where contamination could occur were kept covered with clean ground glass stoppers and plugs, or with heavy duty aluminum foil which had been rinsed with CH_2Cl_2.

The vapor phase semi-volatile compounds of interest were adsorbed on precleaned XAD-2 resin packed in the sorbent modules. The sorbent modules Am Test utilizes are constructed of borosilicate glass with a ball joint on one end and a socket joint on the other end. The resin is held in place with plugs of glass wool which have been solvent extracted and oven-dried. XAD-2 is a porous polymer resin with high surface area which has the capability of adsorbing a broad range of organic species. The sorbent module is expected to give efficient collection of vapor phase organic materials with boiling points greater than approximately 200° F. The glass sorbent cartridges and end caps were cleaned and prepared by the analytical laboratory according to procedures specified in the reference methods. One (1) module was placed in a clean sample train

in the field, the train was leak checked and allowed to sit at the sample site for the same duration as a test. The sample train was then disassembled, the ends were replaced, the module was labeled as the field blank, and the sample train was rinsed and recovered using the same procedures as were used for the samples. One (1) module remained in the container which was used to store the modules and was not opened. The unexposed module was labeled as the trip (or transport) blank. All sorbent modules were kept in a cooler containing blue ice coolant packets, except during sampling.

Prior to sampling, the semi-VOST sample train was assembled and determined to be leak free following the procedures in Method 5. Under no circumstances was silicon stopcock grease used to facilitate passing the leak test. A quartz sample nozzle was attached to a heated quartz probe liner which was used to draw a sample from the gas stream. The probe liner temperature was monitored to assure that condensation did not occur. The probe liner was housed inside a stainless steel probe sheath to prevent breakage. The probe was attached to a glass filter assembly with a Teflon® filter support and Teflon® gasket, containing an ultrapure microfiber quartz filter. The filter was enclosed in a temperature controlled heated sample box. The average sample box temperature surrounding the filter was maintained at a temperature of 248 $\pm$ 25° F. Once the gas passed the quartz fiber filter, it entered an ice water-cooled coil condenser which cooled the gas stream to a temperature below 68° F before it entered a sorbent module packed with XAD-2 resin. The sorbent module has a water-cooled jacket surrounding the resin to further cool the gas and assure that the semi-volatile compounds of interest remain trapped in the resin. The water-cooled coil condenser and sorbent module were mounted vertically atop the first impinger of the sample train. The first impinger was modified with a short stem and acts as a condensate knockout trap. The condensate percolates through the sorbent resin module for subsequent collection for organic analysis. The temperature at the inlet to the sorbent resin module

was monitored with a flexible thermocouple probe which was inserted in a well in the side of the module to assure that the temperature remained below 68° F throughout the test period.

At the downstream side of the sorbent module, four (4) impingers were connected in series and immersed in an ice water bath. The first impinger, or condensate knockout, was connected to the outlet of the sorbent module, and collected any condensate which percolated through the sorbent module. The second impinger was a modified Greenburg-Smith bubbler which contained 100 milliliters of ASTM Type II water for scrubbing acid gas from the gas stream to protect the dry gas meter and pump. The third impinger was empty, and the fourth bubbler contained indicating silica gel desiccant to absorb any moisture from the stack gas before it entered the control box. The back-half section was maintained at a temperature below 68° F by keeping the impingers cooled in an ice water bath. The temperature at the outlet of the silica gel bubbler was monitored.

The sample box was connected to a control box as described for Method 5 testing. Upon completion of each test, the probe was removed from the stack and a post-test leak check was performed according to Method 5 procedures. Post-test leak check procedures include a check through the filter at 15" Hg (or at the maximum vacuum during the run), and a check through the nozzle at a minimum of 1" Hg.

Following sample collection, the sample train was transferred to Am Test's mobile laboratory for recovery. The nozzle and probe were disconnected from the sample box and the ends were capped. Any particulate matter collected on the outside of the probe was wiped off before cleaning the probe liner. The filter holder was also disconnected and the ends were capped. The contents of the nozzle, quartz probe liner and prefilter

glassware were quantitatively transferred to a labeled glass sample container with a Teflon® lined lid. The glassware components in the sample train are rinsed three times with acetone (ACE), then three times with methylene chloride (DCM) and recovered into one sample container. Then the components are given a final rinse with toluene into a separate sample container. The solvents were dispensed from Teflon® squeeze bottles. An iodine flask with a female ball joint end was attached to the male ball joint end of the probe to assure that no liquid was lost during the cleaning of the probe. The probe rinses were transferred to the sample container(s) and the liquid level was noted.

The quartz filter was removed from the filter assembly and transferred to a labeled glass sample container with a Teflon® lined lid. The back-half of the filter holder and the pre-sorbent module connecting glassware, including the coil condenser, were rinsed with acetone, CH_2Cl_2, and toluene into the appropriate sample container which contained the solvents from the probe rinse. The solutions were shipped to the contract laboratory for subsequent extraction and analyses.

Immediately upon completion of a sample run, the labeled sorbent module containing XAD-2 resin was capped with ground glass plugs and stoppers, wrapped in aluminum foil and placed in bubble wrap to protect the modules from breakage, and refrigerated until their contents were extracted. The particulate phase, vapor phase, and aqueous phase fractions from each semi-VOST sample were each extracted and their extracts were combined for concentration in a Kuderna-Danish (K-D) apparatus. All extracts from one (1) tests run were combined and the volume reduced to one (1) milliliter (mL) resulting in one (1) extract per test run. The concentrates were split and analyzed utilizing HRGC/HRMS.

5.5 EPA Method 101A - Mercury

The sample train used for mercury sampling was an EPA Method 101A design as illustrated in the figure titled "EPA Method 101A (Mercury) Sampling Train" in the appendices of this report. The procedures detailed in Chapter 8, Section 3.1.10 of the Portland Cement Association's 1995 Air Toxics Stack Testing Workshop Manual were also followed. The "Sample Train Information Sheet" (also in the appendices) details the type of nozzle, probe, and probe liner used along with the contents of the sample train impingers. The probe was equipped with type S pitot tubes for measuring gas velocity and a thermocouple sensor for measuring stack gas temperature. The thermocouple sensor was connected to a digital thermocouple indicator which was used to measure the stack gas temperature at each sample point. The average heater box temperature was maintained at 248° F ±25° F. The condenser section was maintained at a temperature below 68° F by adding ice to the condenser section throughout sampling. Note: Some subparts or methods specify alternate temperatures for the probe liner and impinger ice bath. The "Sample Train Information Sheet" details any exceptions.

The sample train was connected to a control box by means of an umbilical cord which contained a vacuum hose, pitot lines, thermocouple wires, and a 4-wire electrical cord. The control box (meter box) was used to monitor stack conditions and to facilitate isokinetic sampling. The control box consisted of a diaphragm pump which was used to pull the stack gas through the sample train, fine and coarse metering valves to control the sampling rate, a vacuum gauge to measure the pressure drop from the sample nozzle to the metering valves, and a calibrated dry gas meter readable to 0.001 cubic feet. At the outlet of the dry gas meter was a calibrated orifice which was used to isokinetically control the flow of gas through the metering system. The pitot tubes utilized to measure stack gas velocity were connected to the control box via the

umbilical cord. The control box contained a manometer or magnehelic gauges which were used for the velocity measurement and for monitoring orifice pressure.

Stack condition measurements were made prior to collecting a sample, including measurements of velocity, temperature, static pressure and a check for cyclonic flow in the stack. A sample nozzle was chosen and isokinetic operating parameters were established utilizing a Hewlett-Packard programmable calculator. The sampling nozzle, probe and prefilter connective glassware were cleaned and rinsed with nitric acid (HNO_3) and then with deionized water. The sample train was assembled and determined to be leak free following the procedures outlined in Method 5. Before each test, a final check was made to assure that the process was operating at the desired production rate and operating parameters. A final check was made of the sample box and probe heat temperatures. Crushed ice was added to the condenser section. The sample nozzle was positioned in the stack at the first sample point. The sample pump was then turned on and the gas sampling rate was adjusted for isokinetic sampling. Isokinetic sampling proceeded at each of the traverse points. Upon completion of the test, the sample probe was removed from the stack and a post-test leak check was performed according to Method 5 procedures. Care was taken to assure that the nozzle tip did not touch the port nipple.

Following sample collection, the Method 101A sample trains were transferred to an area free from air disturbances and airborne particulate matter. The contents of the nozzle, and probe liner were quantitatively transferred to a sample container labeled with sample date, client name and run number, following each run. Several rinses of acidified $KMnO_4$, and a small amount of hydrochloric acid (HCl) with simultaneous loosening of particulate matter using a clean nylon brush, were used for the clean-up. An iodine flask with a female ball joint end was attached to the male ball joint end of

the probe to assure that no particulate matter was lost during the rinsing and brushing of the probe. The contents of the iodine flask were quantitatively transferred to a graduated cylinder.

The bubblers and impingers utilized for the condenser section, or "back-half" of the sample train were weighed with a readability of 0.1 grams before and after sampling using an electronic top loading balance. The difference between the initial and final weights of the condenser section constitute the amount of moisture gain during the run. The contents of the bubblers and impingers were transferred to a 1000 mL graduated cylinder. The bubblers and impingers were rinsed with acidified $KMnO_4$ into the graduated cylinder and the liquid level was recorded. Each sample was transferred to a labeled glass amber sample bottle. The samples were submitted to Am Test's Trace Metals laboratory for mercury analysis using EPA Method 245.1 which is a cold vapor atomic absorption (CVAA) spectroscopy technique for measuring low levels of mercury (Hg). Sample blanks containing a field blank of the acidified $KMnO_4$/HCl solution used in the field to clean up the sample trains, and a reagent blank of the acidified $KMnO_4$/HCl solution used for this project were prepared and analyzed along with the samples. The volume of the blank samples were similar to the volumes of the samples. Note: Some subparts or methods specify alternate "B" section cleanup solvents. The "Sample Train Information Sheet" details any exceptions.

6.0
QUALITY ASSURANCE PLAN

The purpose of the quality assurance plan is to provide guidelines for achieving quality control in air pollution measurements. The detailed procedures which are utilized are included in the Environmental Protection Agency's (EPA's) reference manual titled Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3, EPA-600/4-77-027b. These procedures are followed throughout equipment preparation, field sampling, sample recovery, analysis and data reduction. Am Test-Air Quality, LLC's quality assurance procedures are discussed below.

6.1 Calibration Procedures and Frequency

Field equipment utilized for on-site measurements is calibrated at a frequency recommended by the equipment manufacturer or industry practice. Prior to field use, each instrument is calibrated and the calibration value is recorded. If any measuring or test device requiring calibration cannot immediately be removed from service, the Project Manager may extend the calibration cycle providing a review of the equipment's history warrants the issuance of an extension. No equipment will be extended more than twice a calibration cycle, nor will the extension exceed one-half the prescribed calibration cycle. Test equipment consistently found to be out of calibration will be repaired or replaced.

The sample nozzles used to collect isokinetic samples are calibrated on-site before sampling using digital inside calipers readable to 0.001 inch. Three (3) measurements were taken at varying points around the inside of the nozzle tip and averaged. The dry gas meters used to accurately measure sample volumes are calibrated using a standard laboratory dry gas meter. The type S pitot tubes utilized for velocity determination are

calibrated using Method 2, Section 4.1, and are inspected regularly for wear. The magnehelic gauges used for pressure measurements are checked against an oil-filled manometer. The digital thermocouple indicators used for temperature measurement have a readability of 1 degree Fahrenheit and are periodically re-certified by the manufacturer. Each thermocouple probe used to monitor temperature is checked periodically at three (3) temperature settings. Copies of calibration information for each measurement device used are included in the appendices of this report. A barometer readable to 0.01 inches of mercury is used in the field to obtain barometric pressure readings. All reagents used for this project conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, or the best available grade.

The gaseous measurement systems are capable of meeting the system performance specifications detailed in 40 CFR 60, Appendix A, Method 6C, Section 4. For meeting these specifications, the analyzer's calibration error must be less than ± 2 percent of the span for the zero, mid-range, and high-range calibration gases. The sampling system bias must be less than $\pm 5\%$ of the span for the zero, and mid- or high-range calibration gases. The zero drift must be less than $\pm 3\%$ of the span over the period of each run. The calibration drift must be less than $\pm 3\%$ of the span over the period of each run. Copies of certificates of analysis for each tank of calibration gas used are included in the appendices of this report. The calibration gases were analyzed following the EPA Traceability Protocol Number 1, or next best available. Purified nitrogen was utilized as zero gas.

Support equipment is defined as all equipment, not previously discussed, that is required for completing an environmental monitoring or measurement task. This equipment may include storage and transportation containers, sample recovery

glassware, and communications gear. Support equipment is periodically inspected to maintain the performance standards necessary for proper and efficient execution of all tasks and responsibilities.

During a project, a systems audit is performed, consisting of an on-site qualitative inspection and review of the total measurement system. This inspection is conducted on a daily basis by the Project Leader. During the systems audit, the auditor observes the procedures and techniques of the field team in the following general areas:

- Setting up and leak testing the sample train
- Isokinetic sampling check (if applicable)
- Final leak check of the sample train
- Sample recovery

Visual inspections of pitot tubes, glassware, and other equipment are also made. The main purpose of a systems audit is to ensure that the measurement system will generate valid data, if operated properly.

6.2 Sample Recovery and Field Documentation

Data collected during each test, are immediately inspected for completeness and placed under the custody of the Project Leader until custody is transferred when the samples were returned to the Air Quality laboratory. Sample recovery is carried out in a suitable area free from particulate matter contamination. Each sample is assigned an identifying lab number to assist the chemists in tracking the sample.

6.3 Chain of Custody

The history of each sample was documented from collection through all transfers of custody until it was transferred to the analytical laboratory. Copies of the chain of custody forms are included in the appendices of this report. Internal laboratory records document the custody of the samples through their final disposition. Care was taken to

record precisely the sample type, sample time and sample location and to help ensure that the sample number on the label exactly matched those numbers on the sample logsheet and the chain-of-custody record. The persons undertaking the actual sampling in the field were responsible for the care and custody of the samples collected until they were properly transferred or dispatched. Sample labels were completed for each sample bottle using water-proof ink.

6.4 Transfer of Custody and Shipment

All sample shipping containers were accompanied by an analysis request or chain-of-custody record form when they left the site. When transferring the possession of samples, the individuals relinquishing and receiving the samples signed, dated and noted the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory.

The laboratory representative who accepted the incoming sample shipment signed and dated the chain-of-custody record, completing the sample transfer process. It is the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis in accordance with the laboratory's written QA Plan.

It is important to maintain the integrity of the samples from the time of collection until the analyses are performed. Prior to shipping, the samples were packed to avoid breakage along with a chain-of-custody form. Empty space in the box was filled with bubble pack and styrofoam to prevent damage during shipment and ice packs were added, if necessary. The samples were shipped via a courier service.

6.5 Data Reduction, Validation, and Reporting

Raw data are handled according to strict guidelines when being transposed into computer files or to other logs. The guidelines include document receipt control procedures, file review, and sign-off by a project assistant. Raw data are entered into the appropriate computer spreadsheet by a "processor," then the entered figures are checked for accuracy by a "checker," different from the "processor." Any mistakes are corrected, and figures are rechecked and signed off by the "checker." In addition, a by-hand calculation check of each spreadsheet is made using a hand-held calculator to validate the computer output. All data generated by each phase of a laboratory or field sampling program are reviewed by the senior reviewer. The data package is signed off by the senior reviewer prior to releasing the data for report preparation.

The test results were calculated according to EPA 40 CFR 60 criteria. Copies of the pertinent equations used to derive these results are included in the appendices of this report. Standard conditions are 68° F and 29.92 inches of mercury.

7.0
METHODOLOGY REFERENCES

EPA. Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Reference Methods 1, 2, 3A, 4, and 23. July 1, 1995.

EPA. Title 40 Code of Federal Regulations, Parts 61-80 (40 CFR 61), Appendix B, Reference Method 101A. July 1, 1995.

EPA. EPA-600/8-88-085, Guidelines for Stack Testing of Municipal Waste Combustion Facilities, June 1988.

EPA. EPA 450/2-79-006, APTI Course, "Course 450 - Source Sampling For Particulate Pollutants," December 1979.

EPA. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3, EPA-60/4-77-027b.

Section 8.0 has been provided by Gossman Consulting, Inc. for inclusion into this report.

8.0
Mercury Balance

A metals balance was performed of the overall system and of two major subsystems. The Blending subsystem has Raw Feed (Raw Mix), Water and Return Dust as inputs and Kiln Feed as an output. The Kiln subsystem has Kiln Feed, Tires and Coal as inputs and Return Dust, Clinker and Stack emissions as outputs. The Total system has Raw Mix, Water, Tires and Coal as inputs and Clinker and Stack emissions as outputs. See Figure 1.

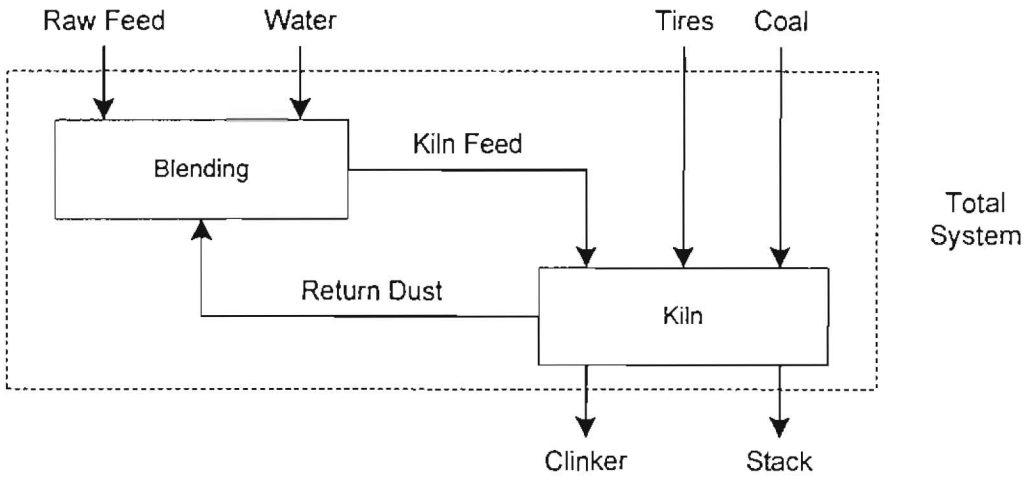


Figure 1.

8.1 Blending Subsystem

The Blending System Input rate was calculated by adding the Raw Feed, the Water and the Return Dust mercury mass flow rates. The Blending System Output rate has a single component, the Kiln Feed rate. The Blending System Input and Output rates were roughly equal when the raw mill was running, demonstrating a metals balance across the Blending subsystem. When the raw mill was turned off, the Kiln Feed mercury levels remained essentially unchanged. This would be expected, as excess Kiln Feed produced when the raw mill was running had merely been stockpiled for continued use while the raw mill was turned off.

8.2 Kiln Subsystem

The Kiln Input rate is calculated by adding the Kiln Feed, the Coal and the Tire mercury mass flow rates. Because the Coal and Tire flow rates were small in comparison to the Kiln Feed flow rates, the Kiln Input happened to be in balance with the Blending System Input since the Kiln Feed was in balance with the Blending System Input. Again, Kiln Input values essentially did not change when the raw mill was turned off.

The Kiln Output is the sum of the Clinker, Stack and Return Dust values. Although the Clinker mercury values remained unchanged between the roller mill running and off sampling times, there is a pronounced change in the corresponding Stack and Return Dust mercury mass flow rates. With the roller mill running, the mercury flow rates found in the Return Dust were an order of magnitude higher than those found in the Stack. With the roller mill off, this relationship is reversed; the mercury flow rates found in the Return Dust were now an order of magnitude less than those found in the Stack.

While the roller mill was running, the mercury levels in the Kiln Feed matched those found in the Return Dust, suggesting that not only had the system achieved equilibrium, but also that the Return Dust mercury levels were the driver in determining the Kiln Feed levels. With the raw mill off, the mercury levels found in the Stack more nearly matched and even slightly exceeded the Kiln Feed levels. The Return Dust levels now were an order of magnitude less than the Kiln Feed levels. This suggests not only that the system had not achieved a new equilibrium, but also that the Kiln Feed may be very slow to shift to reflect changes in the Return Dust. In other words, Return Dust may be the driver in determining mercury levels in Kiln Feed, but it is a process which adjusts relatively slowly.

With the roller mill off, the Kiln Output is increased somewhat because of increased stack emissions, yet is still basically in balance with the Kiln Input. Because lower mercury level Return Dust is accumulated while the roller mill is off and is then slowly reintroduced into the kiln system when the roller mill is turned back on, presumably there would be a period of correspondingly low mercury levels in the stack at some later time.

8.3 Total System

The Total Input rate is calculated by adding the Raw Feed, Water, Tires and Coal mercury mass flow rates. The Total Output is the sum of Clinker and Stack mercury mass flow rates. Kiln Feed and Return Dust values do not appear in the total system metals balance because they are internal to the system. With the raw mill running, the Total Input and Total Output match well with a good metals balance. Both the Total Input and Total Output rates are significantly less than the Kiln Feed and Return Dust mass flow rates, indicating that mercury levels had built up to a stable equilibrium level while the raw mill was running prior to testing.

The Total Input rate and the Total Output rate are not in balance for the samples taken when the raw mill was turned off. This is a strong indicator that the raw mill off sampling was performed while the system was still moving to a different equilibrium point.

With the roller mill running, each subsystem input closely matches the subsystem output and the total system input matches the total system output. This strongly indicates a good metal balance with a system in equilibrium. This robust equilibrium suggests that the roller mill on condition is the appropriate value to reflect accurate annual average mercury levels. In addition, this equilibrium strongly supports the validity and accuracy of the stack testing methods used.

Ash Grove - Seattle, WA
3/25/97 - 3/27/97

Mercury Balance

	Water lb/hr		RawMix lb/hr		Return Dust lb/hr	
	min	max	min	max	min	max
Roller Mill Running	0	1.11E-06	0.006826	0.012678	0.141927	0.263579
Roller Mill Off						

	Blending Input lb/hr		Blending Output lb/hr	
	min	max	min	max
Roller Mill Running	0.148754	0.276258	0.17465	0.32435
Roller Mill Off			0.173745	0.322669

	Kiln Feed lb/hr		Coal lb/hr		Tire lb/hr	
	min	max	min	max	min	max
Roller Mill Running	0.17465	0.32435	0.000793	0.001472	6.27E-05	0.000116
Roller Mill Off	0.173745	0.322669	0.000404	0.001004	4.12E-05	7.65E-05

	Kiln Input lb/hr		Kiln Output lb/hr	
	min	max	min	max
Roller Mill Running	0.175505	0.325939	0.147971	0.279713
Roller Mill Off	0.17419	0.32375	0.243203	0.456561

	Clinker lb/hr		Stack lb/hr		Return Dust lb/hr	
	min	max	min	max	min	max
Roller Mill Running	0	0.004909	0.006044	0.011225	0.141927	0.263579
Roller Mill Off	0	0.004898	0.217686	0.404273	0.025517	0.047389

	Total Input lb/hr		Total Output lb/hr	
	min	max	min	max
Roller Mill Running	0.007682	0.014267	0.006044	0.016133
Roller Mill Off	0.000445	0.001081	0.217686	0.409172

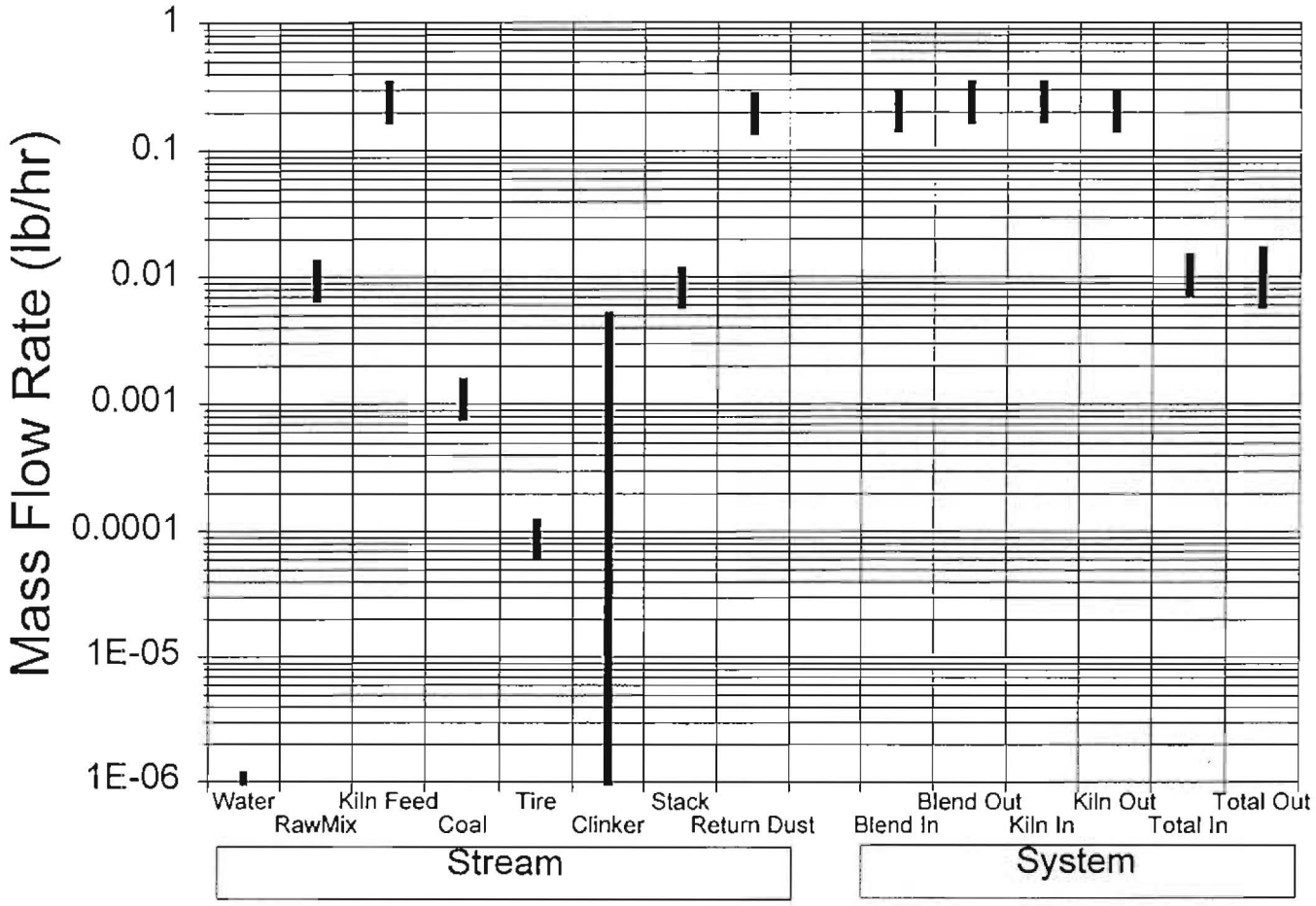
	System Removal Efficiency (%)	
	min	max
Roller Mill Running	93.6044	98.1456
Roller Mill Off	-132.088	32.7611

Blending Input = Water + RawMix + Return Dust
Blending Output = Kiln Feed
Kiln Input = Kiln Feed + Coal + Tire
Kiln Output = Clinker + Stack + Return Dust
Total System Input = Water + RawMix + Coal + Tire
Total System Output = Clinker + Stack

SRE minimum = 100 * (1 - Stack minimum / Kiln Input maximum)
SRE maximum = 100 * (1 - Stack maximum / Kiln Input minimum)

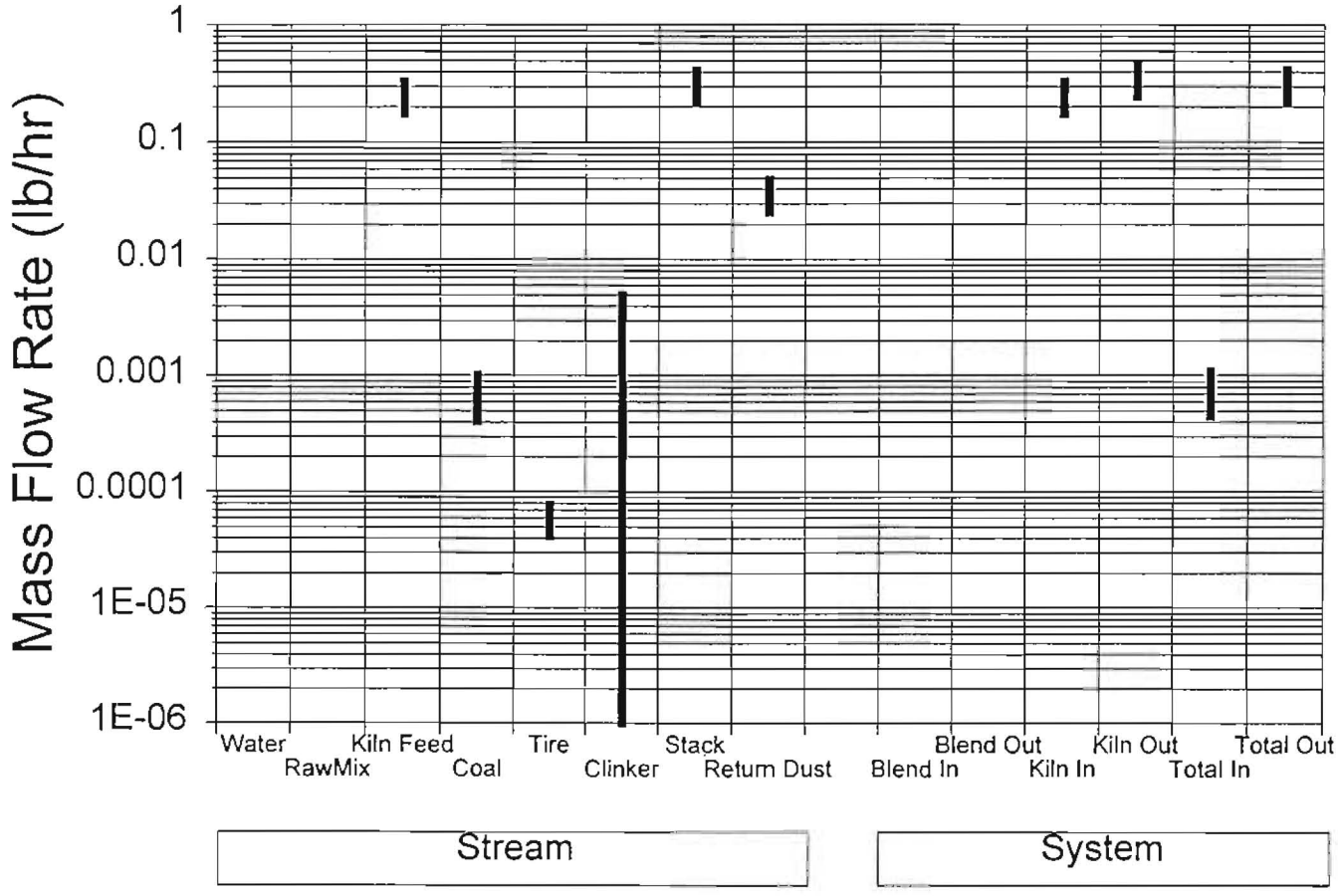
Mercury Balance

Seattle - 3/97 - Raw Mill Running



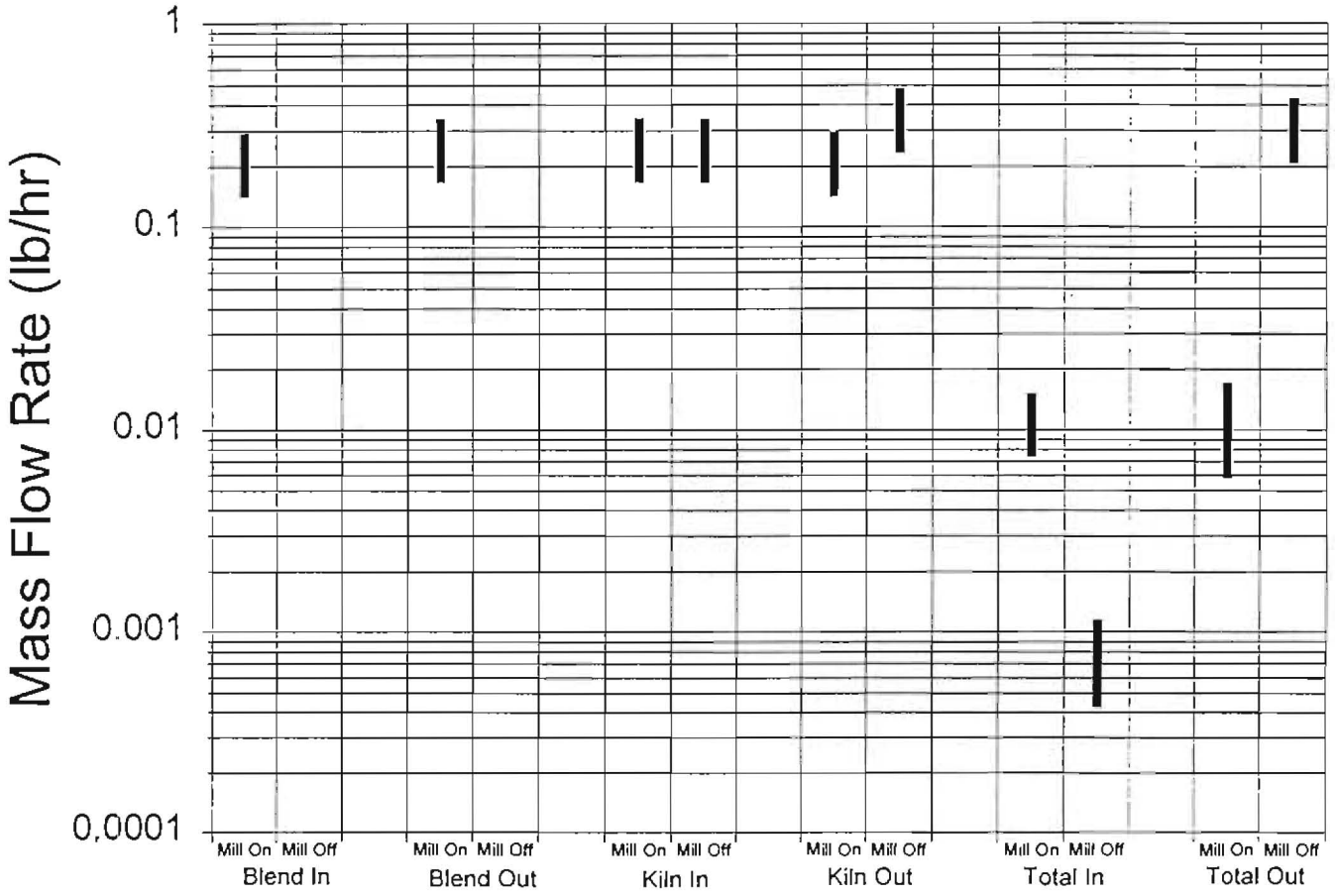
Mercury Balance

Seattle - 3/97 - Raw Mill Off



Mercury Balance

Seattle - 3/97



Ash Grove Cement Company - Seattle, WA Plant
Mercury Study - March, 1997

Stack Emissions

	1	2	4	avg
Roller Mill ON	03/25/97	03/25/97	03/26/97	
	07:00	10:45	13:13	
Mercury	09:10	14:58	15:54	
Stack - µg	40	41	38	40
Stack - ng/dscm	16660	17927	16616	17068
Stack - ng/dscm @ 7% O2	21442	23509	20621	21857
Stack - mg/hr	3965	4034	3761	3920
Stack - lb/hr	0.008733	0.008885	0.008284	0.008634
O2 - %	10.1	10.3	9.7	10.0
flowrate - dscfm	140070	132425	133221	135239
stack temp - °F	228.9	225.5	232.3	228.9

	5	6	7	avg
Roller Mill OFF	03/27/97	03/27/97	03/27/97	
	07:00	10:45	14:50	
Mercury	09:23	12:59	17:10	
Stack - µg	1500	1500	1500	1500
Stack - ng/dscm	793651	814332	811249	806411
Stack - ng/dscm @ 7% O2	861855	832295	756803	816984
Stack - mg/hr	141499	143757	138298	141185
Stack - lb/hr	0.311672	0.316645	0.304621	0.310979
O2 - %	8.1	7.3	6	7.1
flowrate - dscfm	104923	103890	100325	103046
stack temp - °F	395.8	424.8	431.3	417.3

Stream Feed Rates

		Roller Mill ON				Roller Mill OFF			
Run		1	2	4	avg	5	6	7	avg
Roller Mill Raw Feed	tph	172	205	191	189	0	0	0	0
Roller Mill Spray Water	tph	3.83	3.83	3.83	3.8	0	0	0	0.0
Kiln Feed	tph	157	156	155	156	154	154	159	156
Baghouse Return Dust	tph	17.2	20.5	19.1	18.9	12.3	12.3	12.7	12.4
Whole Tires	tph	1.59	1.53	1.08	1	1.26	1.5	0	1
Raw Coal	tph	9.36	5.78	12.7	9.3	11	11.6	14.7	12.4
Clinker	tph	95	94.4	93.8	94.4	93.2	93.2	96.2	94.2

Ash Grove Cement Company - Seattle, WA Plant
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Streams Concentrations in ppm

Water was reported in ug with accompanying sample volume

Run	ug	mls	ppm
1	< 0.03	270	< 0.000111
2	< 0.03	265	< 0.000113
4	< 0.03	270	< 0.000111

Run	Kiln Feed	Return Dust	Clinker
1	0.68	6.2	< 0.02
2	0.89	6	< 0.02
4	0.83	3.9	< 0.02
5	0.82	1.5	< 0.02
6	0.72	1.5	< 0.02
7	0.85	1.4	< 0.02

Run	Coal	Tire	Roller Mill Raw Feed RawMix	Water
1	0.065	0.032	0.039	< 0.000111
2	0.07	0.032	0.02	< 0.000113
4	0.054	0.032	0.02	< 0.000111
5	0.047	0.032		
6	0.03	0.032		
7	< 0.02	0.032		

Section 9.0 has been provided by Gossman Consulting, Inc. for inclusion into this report.

9.0

GCI Quality Assessment Review

Gossman Consulting, Inc. (GCI) has conducted a quality assessment of this test and test report. The assessment is to provide a review of the actual test procedures performed with respect to the test plan, QAPP and methods specified for this test. The actual field sampling for this test was not observed by GCI but was directed and observed by Hans Steuch, the designated process sample manager for Ash Grove Cement. GCI did review the sampling documentation such as sample transfer and chain of custody forms provided in the test report.

9.1 PCDD/PCDF Testing

The PCDD/PCDF sampling and sample management followed the test plan, QAPP, and PCA methods except as noted below.

- The sample train originally designated as the Run-1 sample train was set up and prepared for sampling when a decision to postpone sampling was made by Ash Grove. The next day the original Run-1 sample train was designated as the field blank. The sample train originally to be used as a field blank was used as the Run-1 sample train. The subsequent analysis of this sample train used as the field blank yielded minor PCDD/PCDF contamination.
- Field sampling data sheets are not always filled in consistently for each test run. As an example, the leak check information for Run 2 and for Run 7 are incomplete on the field sampling data sheets. The post-test leak checks are mandatory in the method. Leak checks before the test run are recommended. Leak checks are optional during a test run unless a component of the sample train is changed. A leak check is then mandatory prior to the change.
- Method 23 and PCA guidance requires that the temperature of the gas entering the sorbent trap be maintained below 50∘C at all times and specifically below 20∘C during the actual run. The method 23 sample diagram shows a temperature sensor between the condenser and trap. The test report appendix contained a diagram of the method 23 sample train used for this part of the test. The test report diagram indicates that a

temperature sensor was positioned at the outlet of the trap rather than at the inlet and that the condenser/trap module was positioned above the ice bath. The review of the summaries, computer printouts and field notes did not indicate that temperatures were monitored either for the method 23 position or for the position indicated in the diagram. The test narrative describes that a thermocouple was used to monitor the temperature at the inlet to the sorbent module. Stack testing personnel were asked about this confusion. They confirmed that temperature monitoring took place as described in the narrative but that temperature readings were not documented.

The analysis of the stack samples for PCDD/PCDF followed method 23 as prescribed by the test plan except as noted below. Quality Assurance Objectives, as given in the QAPP of the test plan, were met with the following exceptions.

- The precision evaluation, as described in the QAPP, was not determined by analysis of duplicates because of the low number of samples and cost of running a duplicate. Alta Analytical did multiple runs of the congener standards (LCS1/LCS2) and calculated the relative per cent difference which does give a measure of precision. The 1,2,3,7,8,9-HxCDF congener had a slightly high recovery in the LCS1 run which is not significant. The per cent differences were all within the precision objectives given in the QAPP.
- Alta Analytical substituted the Alternate Recovery Standard compound for the Recovery Standard compounds which are part of the internal recovery standard solution added to each sample prior to analysis. The other components of the recovery standard solution were as listed in method 23 and analysis recoveries and ratios of the components of the solution met the requirements of method 23 for a valid test.
- A method blank was analyzed prior to analysis of the field blank and test run samples. This method blank results showed a minor contaminant of OCDD although the level identified was not significant in the analysis of the test run samples. A method blank was also run prior to the analysis of the trip blank. It likewise showed a low and insignificant level of OCDD contamination.
- Analytical results for the field blank showed the probability of contamination of the field blank sample. The sample train used as a field blank was originally prepared as the

sample train for Run 1, which was postponed after the sample train was set up and leak checked and ready for sampling. This set-up activity may or may not have effected the sample, although it should not have. The level of field blank contamination is not significant in that it is well below levels of concern. However, as a result of the field blank contamination the trip blank, comprised of only the absorbent resin, was analyzed 14 days later on April 25 to check for contamination. This analysis was 17 days beyond the 14 day extraction requirement. If the trip blank was maintained at < 20°C it should not have had an influence on the results. Analytical results of the trip blank did not show the same pattern of contamination as the field blank, but it did show a low level of OCDD similar to the method blanks.

- Alta Analytical did not determine detection limits for the PCDD/PCDF run samples. Detection limits determined for the method blank were used in reporting detection limits for each run in the sample analysis report. This does not specifically follow method 23 nor the QAPP. However, the detection limits from the method blanks do meet the requirements of the QAPP detection limits in magnitude. Given that the results are not used for demonstrating compliance with a source emission standard but for internal review and information, this should not be a problem. The results of the individual run sample analysis show that all ion ratio and signal to noise ratio criteria for acceptable results for method 23 were met for all reported congeners and quality control standards.

9.2 Mercury (Hg) Testing

The mercury (Hg) sampling and sample management followed the test plan, QAPP and PCA guidance methods except as noted below.

- A chain of custody form was not completed for the (Hg) stack samples; AmTest was both the sampling and analysis firm. An analysis request form was initiated for the stack samples, however the lab receiving portion of the form was not completed. As an added note the analysis request form did not specify the analysis method.
- A chain of custody form was prepared by Ash Grove personnel for the process samples. A sample analysis request form was not included for the process samples. The process samples were taken by Ash Grove personnel and were transferred to AmTest for

analysis. The Ash Grove chain of custody form did not indicate the analysis method to be used on the process samples.

- The chain of custody indicated some sampling variations from the test plan and QAPP. Some samples were composites of individual samples taken during the stack sampling run rather than single grab samples for each run as in the test plan and QAPP. This procedure would not effect the accuracy of sample with respect to the overall (Hg) inputs. However, some samples were taken well after the end of the stack sampling run which should normally not be included in a run composite. These streams are large, relatively homogenous and consistent. Therefore, including them will not likely effect the result of determining the input during stack sampling.
- Another variance from the test plan noted from the chain of custody form was that only one sample of tire derived fuel (TDF) was taken. It was taken during the first run of the first day of testing. The test plan called for a tire sample to be taken during each run with these individual samples prepared into a daily composite. This variation is also not significant given the low concentration of (Hg) in TDF, a relatively low mass input rate, and thus a minimal contribution to the overall input of (Hg).
- Raw feed and water samples were not taken during the second phase of testing, which was with the roller-mill down. With the roller-mill down, raw feed and the mill quench water were no longer part of the system input. Therefore the need to sample these streams for the purpose of doing a metal balance was eliminated for this phase of testing.

The (Hg) analysis followed the test plan, QAPP, and the PCA guidance methods except as noted below.

- Analysis of the stack samples and liquid process samples was conducted using EPA method 245.1 rather that SW-846 7470 as given in the QAPP. Laboratory personnel informed GCI that method 245.1 is the same as 7470; it is the normal method that they use for this analysis, and that 245.1 is referenced in 7470. A comparison of the two methods shows that they are very similar. These methods are for analyzing very similar matrix's, and 7470 does reference 245.1 for it's precision and accuracy measures. The

effects of this apparent method variation are not significant for these sample analysis results.

- Analysis of the solid process samples was conducted using method SW-846 7470 rather than 7471 as given in the QAPP. Laboratory personnel informed GCI that methods 7470 and 7471 were the same. A review of the methods suggest that the methods are similar but that the differences between them are real and are to account for the matrix differences. Method 7470 specifies that it is for liquid samples but may be used for certain solid and sludge-type wastes. Method 7470 also states however, that 7471 is usually the method of choice for these waste types. The two methods are similar but differ primarily in the dissolution reagents. Method 7471 uses a more aggressive acid reagent for the solid matrix's. This variation in method did not, in this case, appear to have an effect because the metal balance performed on the system suggests that all of the mercury was accounted for.
- The analysis for and reporting of total solids is not part of the test plan, QAPP, or PCA methods. It was performed by the laboratory because it is routinely done on these types of samples for any analysis that is performed. The analysis for all samples was done on the total sample, and no adjustment to the results was made based on the solids reported. Therefore, this variation has no effect on the test results.

9.3 Quality Control and Assurance of the Testing

Quality assurance objectives from the QAPP were met or exceeded with the following exceptions.

- The precision objectives, through running of duplicates, were tested for on four of the eight sample types, all met the QAPP criteria, although the QAPP specified objectives for all eight sample types.
- The accuracy objectives, through spike recoveries, were tested for on four of eight sample types, all met the QAPP criteria, although the QAPP specified objectives for all eight. Four method blanks were run with the process samples but there were seven sample types.

This review of the test shows that testing followed the test methods and procedures with some variations. However, the variations were not significant enough to cause major errors in the results. Therefore, the information from the testing is deemed reliable.

APPENDIX A

Computer Printouts of Results

METHODS 1, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R1	LAB #:	1451
CLIENT:	Ash Grove Cement Company	START TIME:	0700 hours
LOCATION:	Seattle, Washington	STOP TIME:	1013 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 25, 1997		
RUN #:	1 - Method 4/23		
OPERATOR:	Guenthoer/Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
659.9	338.0	321.9
447.0	447.0	0.0
357.3	354.6	2.7
788.0	761.5	26.5

TOTAL H2O GAIN:	351.1	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	16.55	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	12.06	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1206	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	840.322	METER TEMPERATURE:	66.2 degrees F
FINAL METER VOLUME:	962.526	BAROMETRIC PRES.:	30.05 inches Hg
VOLUME SAMPLED:	122.204	STATIC PRESSURE:	-0.50 inches H2O
STD VOLUME (dscf):	120.687	STACK PRESSURE:	30.01 inches Hg
STD VOLUME (dscm):	3.418	ORIFICE PRESSURE:	1.659 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.17 inches Hg
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.984	AVERAGE CONC. CO2:	18.7 percent
PERCENT ERROR (%):	0.8	AVERAGE CONC. O2:	10.1 percent
		MOLECULAR WEIGHT:	31.40 g/g-mole-dry
		MOLECULAR WEIGHT:	29.78 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	1	0.10	223	SE	1	0.12	222
	2	0.15	227		2	0.15	229
	3	0.20	229		3	0.18	230
SW	1	0.11	224	NE	1	0.11	223
	2	0.19	230		2	0.15	227
	3	0.19	231		3	0.17	228

PERCENT ISOKINETICS:	98 %	
STACK GAS TEMPERATURE:	226.9 degrees F	686.9 degrees R
AVERAGE VELOCITY HEAD:	0.150 inches H2O	
STACK GAS VELOCITY:		24.4 ft/sec
STACK GAS AIR FLOW:	194005 acf/min	131543 dscf/min

METHODS 1, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R2	LAB #:	1452
CLIENT:	Ash Grove Cement Company	START TIME:	1117 hours
LOCATION:	Seattle, Washington	STOP TIME:	1435 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 25, 1997		
RUN #:	2 - Method 4/23		
OPERATOR:	Guenthoer		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
642.1	315.4	326.7
467.3	460.5	6.8
330.8	327.8	3.0
799.9	767.7	32.2

TOTAL H2O GAIN:	368.7	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	17.38	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	12.82	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1282	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
		METER TEMPERATURE:	67.6 degrees F
		BAROMETRIC PRES.:	30.05 inches Hg
		STATIC PRESSURE:	-0.50 inches H2O
		STACK PRESSURE:	30.01 inches Hg
		ORIFICE PRESSURE:	1.595 inches H2O
		METER PRESSURE:	30.17 inches Hg
INIT. METER VOLUME:	963.655	AVERAGE CONC. CO2:	18.1 percent
FINAL METER VOLUME:	1083.679	AVERAGE CONC. O2:	10.4 percent
VOLUME SAMPLED:	120.024	MOLECULAR WEIGHT:	31.31 g/g-mole-dry
STD VOLUME (dscf):	118.201	MOLECULAR WEIGHT:	29.61 g/g-mole-wet
STD VOLUME (dscm):	3.348		
Y FACTOR:	0.976		
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.985		
PERCENT ERROR (%):	0.9		

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	1	0.11	224	SE	1	0.10	220
	2	0.14	229		2	0.15	220
	3	0.17	230		3	0.18	216
SW	1	0.11	229	NE	1	0.12	205
	2	0.17	229		2	0.15	212
	3	0.18	231		3	0.16	216

PERCENT ISOKINETICS:	98 %	
STACK GAS TEMPERATURE:	221.8 degrees F	681.8 degrees R
AVERAGE VELOCITY HEAD:	0.144 inches H2O	
STACK GAS VELOCITY:		23.8 ft/sec
STACK GAS AIR FLOW:	189855 acf/min	128585 dscf/min

METHODS 1, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R4	LAB #:	1453
CLIENT:	Ash Grove Cement Company	START TIME:	1303 hours
LOCATION:	Seattle, Washington	STOP TIME:	1613 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 26, 1997		
RUN #:	4 - Method 4/23		
OPERATOR:	Clark		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
636.3	340.3	296.0
450.0	452.0	-2.0
356.9	355.2	1.7
816.4	790.4	26.0

TOTAL H2O GAIN:	321.7	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	15.17	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	11.15	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1115	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	113.982	METER TEMPERATURE:	58.6 degrees F
FINAL METER VOLUME:	235.564	BAROMETRIC PRES.:	29.80 inches Hg
VOLUME SAMPLED:	121.582	STATIC PRESSURE:	-0.50 inches H2O
STD VOLUME (dscf):	120.817	STACK PRESSURE:	29.76 inches Hg
STD VOLUME (dscm):	3.422	ORIFICE PRESSURE:	1.640 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	29.92 inches Hg
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.978	AVERAGE CONC. CO2:	19.8 percent
PERCENT ERROR (%):	0.2	AVERAGE CONC. O2:	9.7 percent
		MOLECULAR WEIGHT:	31.56 g/g-mole-dry
		MOLECULAR WEIGHT:	30.04 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	3	0.17	253	SE	3	0.16	230
	2	0.16	247		2	0.15	226
	1	0.13	242		1	0.12	223
SW	3	0.18	236	NE	3	0.17	222
	2	0.17	238		2	0.13	224
	1	0.11	230		1	0.11	223

PERCENT ISOKINETICS:	100 %	
STACK GAS TEMPERATURE:	232.8 degrees F	692.8 degrees R
AVERAGE VELOCITY HEAD:	0.146 inches H2O	
STACK GAS VELOCITY:		24.1 ft/sec
STACK GAS AIR FLOW:	192106 acf/min	129390 dscf/min

METHOOS I, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R5	LAB #:	I454
CLIENT:	Ash Grove Cement Company	START TIME:	0700 hours
LOCATION:	Seattle, Washington	STOP TIME:	10I1 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 27, I997		
RUN #:	5 - Method 4/23		
OPERATOR:	Guenthoer		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
514.6	319.9	194.7
448.0	447.6	0.4
335.2	334.6	0.6
895.5	875.2	20.3

TOTAL H2O GAIN:	216.0	PITOT TU8E Cp:	0.84
TOTAL VOLUME (scf):	10.18	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	9.13	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.0913	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	235.947	METER TEMPERATURE:	55.3 degrees F
FINAL METER VOLUME:	336.792	8AROMETRIC PRES.:	30.00 inches Hg
VOLUME SAMPLED:	100.845	STATIC PRESSURE:	-0.65 inches H20
STD VOLUME (dscf):	101.408	STACK PRESSURE:	29.95 inches Hg
STD VOLUME (dscm):	2.872	ORIFICE PRESSURE:	1.163 inches H20
Y FACTOR:	0.976	METER PRESSURE:	30.09 inches Hg
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.980	AVERAGE CONC. CO2:	22.9 percent
PERCENT ERROR (%):	0.5	AVERAGE CONC. 02:	7.8 percent
		MOLECULAR WEIGHT:	31.98 g/g-mole-dry
		MOLECULAR WEIGHT:	30.70 g/g-mole-wet

SAMPLE POINT		VELOCITY " H20	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H20	TEMPERATURE °F
NW	3	0.17	362	SE	3	0.140	412
	2	0.11	366		2	0.150	423
	1	0.06	367		1	0.085	410
SW	3	0.14	386	NE	3	0.140	416
	2	0.11	403		2	0.110	421
	1	0.0B	400		1	0.070	412

PERCENT ISOKINETICS:	105 %	
STACK GAS TEMPERATURE:	398.2 degrees F	858.2 degrees R
AVERAGE VELOCITY HEAD:	0.111 inches H20	
STACK GAS VELOCITY:		23.1 ft/sec
STACK GAS AIR FLOW:	184208 acf/min	103104 dscf/min

METHODS 1, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R6	LAB #:	1455
CLIENT:	Ash Grove Cement Company	START TIME:	1045 hours
LOCATION:	Seattle, Washington	STOP TIME:	1356 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 27, 1997		
RUN #:	6 - Method 4/23		
OPERATOR:	Guenthoer		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
510.4	317.2	193.2
461.5	461.4	0.1
330.1	328.6	1.5
846.7	822.7	24.0

TOTAL H2O GAIN:	218.8	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	10.32	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	9.65	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.0965	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	336.987	METER TEMPERATURE:	58.3 degrees F
FINAL METER VOLUME:	433.646	BAROMETRIC PRES.:	30.00 inches Hg
VOLUME SAMPLED:	96.659	STATIC PRESSURE:	-0.65 inches H2O
STD VOLUME (dscf):	96.614	STACK PRESSURE:	29.95 inches Hg
STD VOLUME (dscm):	2.736	ORIFICE PRESSURE:	1.071 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.08 inches Hg
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.984	AVERAGE CONC. CO2:	23.4 percent
PERCENT ERROR (%):	0.8	AVERAGE CONC. O2:	7.0 percent
		MOLECULAR WEIGHT:	32.02 g/g-mole-dry
		MOLECULAR WEIGHT:	30.67 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	3	0.120	426	SE	3	0.130	434
	2	0.115	427		2	0.130	432
	1	0.075	414		1	0.080	413
SW	3	0.120	423	NE	3	0.130	419
	2	0.110	432		2	0.130	421
	1	0.080	424		1	0.090	417

PERCENT ISOKINETICS:	103 %	
STACK GAS TEMPERATURE:	423.5 degrees F	883.5 degrees R
AVERAGE VELOCITY HEAD:	0.108 inches H2O	
STACK GAS VELOCITY:		23.2 ft/sec
STACK GAS AIR FLOW:	184397 acf/min	99675 dscf/min

METHODS 1, 2, 3A, 4 AND 23
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\23R7	LAB #:	1456
CLIENT:	Ash Grove Cement Company	START TIME:	1455 hours
LOCATION:	Seattle, Washington	STOP TIME:	1806 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	180.0 minutes
SAMPLE DATE:	March 27, 1997		
RUN #:	7 - Method 4/23		
OPERATOR:	Orton		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
566.2	377.1	189.1
375.7	376.4	-0.7
371.7	370.4	1.3
815.7	794.3	21.4

TOTAL H2O GAIN:	211.1	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	9.95	NOZZLE DIAMETER:	0.356 inches
PERCENT MOISTURE:	9.43	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.0943	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	433.856	METER TEMPERATURE:	62.0 degrees F
FINAL METER VOLUME:	530.199	BAROMETRIC PRES.:	30.00 inches Hg
VOLUME SAMPLED:	96.343	STATIC PRESSURE:	-0.65 inches H2O
STD VOLUME (dscf):	95.617	STACK PRESSURE:	29.95 inches Hg
STD VOLUME (dscm):	2.708	ORIFICE PRESSURE:	1.075 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.08 inches Hg
DELTA H @:	1.910		
Y FACTOR CAL. CHECK:	0.990	AVERAGE CONC. CO2:	24.6 percent
PERCENT ERROR (%):	1.4	AVERAGE CONC. O2:	6.1 percent
		MOLECULAR WEIGHT:	32.18 g/g-mole-dry
		MOLECULAR WEIGHT:	30.84 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	3	0.13	427	SE	3	0.12	441
	2	0.11	429		2	0.11	437
	1	0.08	420		1	0.07	420
SW	3	0.13	421	NE	3	0.13	436
	2	0.12	434		2	0.14	435
	1	0.07	417		1	0.08	422

PERCENT ISOKINETICS:	104 %	
STACK GAS TEMPERATURE:	428.3 degrees F	888.3 degrees R
AVERAGE VELOCITY HEAD:	0.106 inches H2O	
STACK GAS VELOCITY:		22.9 ft/sec
STACK GAS AIR FLOW:	182574 acf/min	98400 dscf/min

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R1	LAB NUMBER(S):	1451, 3499-0002-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.418	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	131543	dscf/min
SAMPLE TIMES:	0700-1013	OXYGEN (%):	10.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 1 pg	DL Run 1 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	3.3 U	3.3	2.8 U
TCDDs (total)	7.5	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	1.3 U	1.3	1.2 U
PeCDDs (total)	9.4	0.9	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	2.0 U	2.0	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	1.8 U	1.8	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	1.7 U	1.7	2.1 U
HxCDDs (total)	14	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	8.1	1.1	3.9
HpCDDs (total)	15	1.1	7.5
OCDD	58 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	2.2 U	2.2	18
TCDFs (total)	29	1.5	110
1, 2, 3, 7, 8-PeCDF	1.3 U	1.3	4.0
2, 3, 4, 7, 8-PeCDF	1.3 U	1.3	9.3
PeCDFs (total)	1.6 U	1.6	43
1, 2, 3, 4, 7, 8-HxCDF	2.1	0.36	2.7
1, 2, 3, 6, 7, 8-HxCDF	1.4 U	1.4	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	2.3	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	1.0 U	1.0	1.4 U
HxCDFs (total)	7.8	0.41	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	7.7	0.52	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	1.0 U	1.0	1.4 U
HpCDFs (total)	7.7	0.68	3.3
OCDF	13	2.0	5.1
Toxic Equivalent (TEQ)	0.67		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R2	LAB NUMBER(S):	1452, 3499-0003-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.348	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	128585	dscf/min
SAMPLE TIMES:	1117-1435	OXYGEN (%):	10.4	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 2 pg	DL Run 2 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	2.8 U	2.8	2.8 U
TCDDs (total)	22	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	11	0.91	1.2 U
PeCDDs (total)	74	0.91	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	23	1.6	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	26	1.4	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	31	1.4	2.1 U
HxCDDs (total)	290	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	330	1.1	3.9
HpCDDs (total)	590	1.1	7.5
OCDD	2200 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	6.3	1.5	18
TCDFs (total)	130	1.5	110
1, 2, 3, 7, 8-PeCDF	19	1.5	4.0
2, 3, 4, 7, 8-PeCDF	31	1.5	9.3
PeCDFs (total)	300	1.5	43
1, 2, 3, 4, 7, 8-HxCDF	87	0.36	2.7
1, 2, 3, 6, 7, 8-HxCDF	79	0.28	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	180	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	34	0.41	1.4 U
HxCDFs (total)	880	0.41	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	920	0.52	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	100	0.68	1.4 U
HpCDFs (total)	1300	0.68	3.3
OCDF	770	2.0	5.1
Toxic Equivalent (TEQ)	85		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R4	LAB NUMBER(S):	1453, 3499-0004-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.422	dscm
SAMPLE DATE:	March 26, 1997	AIRFLOW:	129390	dscf/min
SAMPLE TIMES:	1303-1613	OXYGEN (%):	9.7	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 4 pg	DL Run 4 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	1.9 U	1.9	2.8 U
TCDDs (total)	5.6	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	1.0 U	1.0	1.2 U
PeCDDs (total)	8.0	0.91	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	1.5 U	1.5	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	1.9 U	1.9	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	1.3 U	1.3	2.1 U
HxCDDs (total)	14	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	8.6	1.1	3.9
HpCDDs (total)	15	1.1	7.5
OCDD	68 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	2.4 U	2.4	18
TCDFs (total)	13	1.5	110
1, 2, 3, 7, 8-PeCDF	1.7 U	1.7	4.0
2, 3, 4, 7, 8-PeCDF	1.6 U	1.6	9.3
PeCDFs (total)	1.7 U	1.7	43
1, 2, 3, 4, 7, 8-HxCDF	0.83 U	0.83	2.7
1, 2, 3, 6, 7, 8-HxCDF	0.85 U	0.85	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	1.3	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	1.0 U	1.0	1.4 U
HxCDFs (total)	3.3	0.35	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	6.0	0.41	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	0.68 U	0.68	1.4 U
HpCDFs (total)	11	0.68	3.3
OCDF	9.9	2.0	5.1
Toxic Equivalent (TEQ)	0.35		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R5	LAB NUMBER(S):	1454, 3499-0005-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.872	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	103104	dscf/min
SAMPLE TIMES:	0700-1011	OXYGEN (%):	7.8	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 5 pg	DL Run 5 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	14	2.4	2.8 U
TCDDs (total)	3000	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	20	0.9	1.2 U
PeCDDs (total)	610	0.9	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	16	1.6	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	18	1.4	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	12	1.4	2.1 U
HxCDDs (total)	530	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	65	1.1	3.9
HpCDDs (total)	140	1.1	7.5
OCDD	140 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	83	1.5	18
TCDFs (total)	8100	1.5	110
1, 2, 3, 7, 8-PeCDF	14	1.5	4.0
2, 3, 4, 7, 8-PeCDF	18	1.5	9.3
PeCDFs (total)	230	1.5	43
1, 2, 3, 4, 7, 8-HxCDF	9.9	0.36	2.7
1, 2, 3, 6, 7, 8-HxCDF	6.5	0.28	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	8.7	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	2.7	0.41	1.4 U
HxCDFs (total)	66	0.41	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	22	0.52	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	6.5	0.68	1.4 U
HpCDFs (total)	35	0.68	3.3
OCDF	24	2.0	5.1
Toxic Equivalent (TEQ)	50		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R6	LAB NUMBER(S):	1455, 3499-0006-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.736	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	99675	dscf/min
SAMPLE TIMES:	1045-1356	OXYGEN (%):	7.0	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 6 pg	DL Run 6 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	22	2.4	2.8 U
TCDDs (total)	5100	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	36	0.9	1.2 U
PeCDDs (total)	1700	0.9	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	24	1.6	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	22	1.4	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	15	1.4	2.1 U
HxCDDs (total)	790	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	71	1.1	3.9
HpCDDs (total)	150	1.1	7.5
OCDD	120 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	200	1.5	18
TCDFs (total)	20000	1.5	110
1, 2, 3, 7, 8-PeCDF	25	1.5	4.0
2, 3, 4, 7, 8-PeCDF	33	1.5	9.3
PeCDFs (total)	970	1.5	43
1, 2, 3, 4, 7, 8-HxCDF	10	0.36	2.7
1, 2, 3, 6, 7, 8-HxCDF	7.7	0.28	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	9.4	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	2.6	0.41	1.4 U
HxCDFs (total)	91	0.41	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	21	0.52	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	3.2	0.68	1.4 U
HpCDFs (total)	33	0.68	3.3
OCDF	14	2.0	5.1
Toxic Equivalent (TEQ)	88		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R7	LAB NUMBER(S):	1456, 3499-0007-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.708	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	98400	dscf/min
SAMPLE TIMES:	1455-1806	OXYGEN (%):	6.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 7 pg	DL Run 7 pg	Field Blank pg
DIOXINS			
2, 3, 7, 8-TCDD	26	2.4	2.8 U
TCDDs (total)	5700	2.7	3.0 U
1, 2, 3, 7, 8-PeCDD	45	0.9	1.2 U
PeCDDs (total)	2100	0.9	1.2 U
1, 2, 3, 4, 7, 8-HxCDD	33	1.6	2.4 U
1, 2, 3, 6, 7, 8-HxCDD	30	1.4	2.2 U
1, 2, 3, 7, 8, 9-HxCDD	24	1.4	2.1 U
HxCDDs (total)	960	1.6	2.4 U
1,2,3,4,6,7,8-HpCDD	130	1.1	3.9
HpCDDs (total)	270	1.1	7.5
OCDD	520 M	1.1 E	34 M
FURANS			
2, 3, 7, 8-TCDF	190	1.5	18
TCDFs (total)	18000	1.5	110
1, 2, 3, 7, 8-PeCDF	32	1.5	4.0
2, 3, 4, 7, 8-PeCDF	42	1.5	9.3
PeCDFs (total)	1000	1.5	43
1, 2, 3, 4, 7, 8-HxCDF	31	0.36	2.7
1, 2, 3, 6, 7, 8-HxCDF	27	0.28	0.9 U
2, 3, 4, 6, 7, 8-HxCDF	48	0.35	1.2 U
1, 2, 3, 7, 8, 9-HxCDF	11	0.41	1.4 U
HxCDFs (total)	290	0.41	7.0
1, 2, 3, 4, 6, 7, 8-HpCDF	210	0.52	3.3
1, 2, 3, 4, 7, 8, 9-HpCDF	28	0.68	1.4 U
HpCDFs (total)	320	0.68	3.3
OCDF	190	2.0	5.1
Toxic Equivalent (TEQ)	96		7.0

pg = picograms of sample collected.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R1	LAB NUMBER(S):	1451, 3499-0002-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.418	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	131543	dscf/min
SAMPLE TIMES:	0700-1013	OXYGEN (%):	10.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 1 ng/m^3	DL Run 1 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.002	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.0004 U	0.0004	0.0004 U
PeCDDs (total)	0.003	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.001 U	0.0006	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.001 U	0.0005	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.0005 U	0.0005	0.001 U
HxCDDs (total)	0.004	0.0005	0.001 U
1,2,3,4,6,7,8-HpCDD	0.002	0.0003	0.001
HpCDDs (total)	0.004	0.0003	0.002
OCDD	0.017 M	0.0003 E	0.010 M
FURANS			
2, 3, 7, 8-TCDF	0.001 U	0.0006	0.005
TCDFs (total)	0.008	0.0004	0.032
1, 2, 3, 7, 8-PeCDF	0.0004 U	0.0004	0.001
2, 3, 4, 7, 8-PeCDF	0.0004 U	0.0004	0.003
PeCDFs (total)	0.0005 U	0.0005	0.013
1, 2, 3, 4, 7, 8-HxCDF	0.001	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.0004 U	0.0004	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.001	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.0003 U	0.0003	0.0004 U
HxCDFs (total)	0.002	0.0001	0.002
1, 2, 3, 4, 6, 7, 8-HpCDF	0.002	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.0003 U	0.0003	0.0004 U
HpCDFs (total)	0.002	0.0002	0.001
OCDF	0.004	0.0006	0.001
Toxic Equivalent (TEQ)	0.0002		0.002

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R2	LAB NUMBER(S):	1452, 3499-0003-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.348	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	128585	dscf/min
SAMPLE TIMES:	1117-1435	OXYGEN (%):	10.4	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 2 ng/m^3	DL Run 2 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.007	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.003	0.0003	0.0004 U
PeCDDs (total)	0.022	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.007	0.0005	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.008	0.0004	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.009	0.0004	0.001 U
HxCDDs (total)	0.087	0.0005	0.001 U
1,2,3,4,6,7,8-HpCDD	0.099	0.0003	0.001
HpCDDs (total)	0.176	0.0003	0.002
OCDD	0.657 M	0.0003 E	0.010 M
FURANS			
2, 3, 7, 8-TCDF	0.002	0.0004	0.005
TCDFs (total)	0.039	0.0004	0.033
1, 2, 3, 7, 8-PeCDF	0.006	0.0004	0.001
2, 3, 4, 7, 8-PeCDF	0.009	0.0004	0.003
PeCDFs (total)	0.090	0.0004	0.013
1, 2, 3, 4, 7, 8-HxCDF	0.026	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.024	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.054	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.010	0.0001	0.0004 U
HxCDFs (total)	0.263	0.0001	0.002
1, 2, 3, 4, 6, 7, 8-HpCDF	0.275	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.030	0.0002	0.0004 U
HpCDFs (total)	0.388	0.0002	0.001
OCDF	0.230	0.001	0.002
Toxic Equivalent (TEQ)	0.025		0.002

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R4	LAB NUMBER(S):	1453, 3499-0004-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.422	dscm
SAMPLE DATE:	March 26, 1997	AIRFLOW:	129390	dscf/min
SAMPLE TIMES:	1303-1613	OXYGEN (%):	9.7	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 4 ng/m^3	DL Run 4 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.002	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.0003 U	0.0003	0.0004 U
PeCDDs (total)	0.002	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.0004 U	0.0004	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.0006 U	0.0006	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.0004 U	0.0004	0.001 U
HxCDDs (total)	0.004	0.0005	0.001 U
1,2,3,4,6,7,8-HpCDD	0.003	0.0003	0.001
HpCDDs (total)	0.004	0.0003	0.002
OCDD	0.020 M	0.0003 E	0.010 M
FURANS			
2, 3, 7, 8-TCDF	0.001 U	0.001	0.005
TCDFs (total)	0.004	0.0004	0.032
1, 2, 3, 7, 8-PeCDF	0.0005 U	0.0005	0.001
2, 3, 4, 7, 8-PeCDF	0.0005 U	0.0005	0.003
PeCDFs (total)	0.0005 U	0.0005	0.013
1, 2, 3, 4, 7, 8-HxCDF	0.0002 U	0.0002	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.0002 U	0.0002	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.0004	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.0003 U	0.0003	0.0004 U
HxCDFs (total)	0.001	0.0001	0.002
1, 2, 3, 4, 6, 7, 8-HpCDF	0.002	0.0001	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.0002 U	0.0002	0.0004 U
HpCDFs (total)	0.003	0.0002	0.001
OCDF	0.003	0.001	0.001
Toxic Equivalent (TEQ)	0.0001		0.002

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R5	LAB NUMBER(S):	1454, 3499-0005-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.872	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	103104	dscf/min
SAMPLE TIMES:	0700-1011	OXYGEN (%):	7.8	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 5 ng/m^3	DL Run 5 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.005	0.001	0.001 U
TCDDs (total)	1.04	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.007	0.0003	0.0004 U
PeCDDs (total)	0.212	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.006	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.006	0.0005	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.004	0.0005	0.001 U
HxCDDs (total)	0.185	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.023	0.0004	0.001
HpCDDs (total)	0.049	0.0004	0.003
OCDD	0.049 M	0.0004 E	0.012 M
FURANS			
2, 3, 7, 8-TCDF	0.029	0.001	0.006
TCDFs (total)	2.82	0.0005	0.038
1, 2, 3, 7, 8-PeCDF	0.005	0.0005	0.001
2, 3, 4, 7, 8-PeCDF	0.006	0.0005	0.003
PeCDFs (total)	0.080	0.0005	0.015
1, 2, 3, 4, 7, 8-HxCDF	0.003	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.002	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.003	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.001	0.0001	0.0005 U
HxCDFs (total)	0.023	0.0001	0.002
1, 2, 3, 4, 6, 7, 8-HpCDF	0.008	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.002	0.0002	0.0005 U
HpCDFs (total)	0.012	0.0002	0.001
OCDF	0.008	0.001	0.002
Toxic Equivalent (TEQ)	0.017		0.002

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R6	LAB NUMBER(S):	1455, 3499-0006-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.736	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	99675	dscf/min
SAMPLE TIMES:	1045-1356	OXYGEN (%):	7.0	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 6 ng/m^3	DL Run 6 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.008	0.001	0.001 U
TCDDs (total)	1.86	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.013	0.0003	0.0004 U
PeCDDs (total)	0.621	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.009	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.008	0.0005	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.005	0.0005	0.001 U
HxCDDs (total)	0.289	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.026	0.0004	0.001
HpCDDs (total)	0.055	0.0004	0.003
OCDD	0.044 M	0.0004 E	0.012 M
FURANS			
2, 3, 7, 8-TCDF	0.073	0.001	0.007
TCDFs (total)	7.31	0.0005	0.040
1, 2, 3, 7, 8-PeCDF	0.009	0.0005	0.001
2, 3, 4, 7, 8-PeCDF	0.012	0.0005	0.003
PeCDFs (total)	0.355	0.0005	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.004	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.003	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.003	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.001	0.0001	0.001 U
HxCDFs (total)	0.033	0.0001	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.008	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.001	0.0002	0.001 U
HpCDFs (total)	0.012	0.0002	0.001
OCDF	0.005	0.001	0.002
Toxic Equivalent (TEQ)	0.032		0.003

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R7	LAB NUMBER(S):	1456, 3499-0007-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.708	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	98400	dscf/min
SAMPLE TIMES:	1455-1806	OXYGEN (%):	6.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 7 ng/m^3	DL Run 7 ng/m^3	Field Blank ng/m^3
DIOXINS			
2, 3, 7, 8-TCDD	0.010	0.001	0.001 U
TCDDs (total)	2.10	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.017	0.0003	0.0004 U
PeCDDs (total)	0.775	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.012	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.011	0.0005	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.009	0.0005	0.001 U
HxCDDs (total)	0.355	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.048	0.0004	0.001
HpCDDs (total)	0.100	0.0004	0.003
OCDD	0.192 M	0.0004 E	0.013 M
FURANS			
2, 3, 7, 8-TCDF	0.070	0.001	0.007
TCDFs (total)	6.65	0.0006	0.041
1, 2, 3, 7, 8-PeCDF	0.012	0.0006	0.001
2, 3, 4, 7, 8-PeCDF	0.016	0.0006	0.003
PeCDFs (total)	0.369	0.0006	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.011	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.010	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.018	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.004	0.0002	0.001 U
HxCDFs (total)	0.107	0.0002	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.078	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.010	0.0003	0.001 U
HpCDFs (total)	0.118	0.0003	0.001
OCDF	0.070	0.001	0.002
Toxic Equivalent (TEQ)	0.035		0.003

ng/m^3 = nanograms of analyte collected per dry standard cubic meter of gas sampled.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R1	LAB NUMBER(S):	1451, 3499-0002-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.418	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	131543	dscf/min
SAMPLE TIMES:	0700-1013	OXYGEN (%):	10.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 1 ng/m^3 @ 7% O_2	DL Run 1 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.003	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.000 U	0.0005	0.0005 U
PeCDDs (total)	0.004	0.0003	0.0005 U
1, 2, 3, 4, 7, 8-HxCDD	0.001 U	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.001 U	0.001	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.001 U	0.001	0.001 U
HxCDDs (total)	0.005	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.003	0.0004	0.001
HpCDDs (total)	0.006	0.0004	0.003
OCDD	0.022 M	0.0004 E	0.013 M
FURANS			
2, 3, 7, 8-TCDF	0.001 U	0.001	0.007
TCDFs (total)	0.011	0.001	0.041
1, 2, 3, 7, 8-PeCDF	0.0005 U	0.0005	0.002
2, 3, 4, 7, 8-PeCDF	0.0005 U	0.0005	0.004
PeCDFs (total)	0.001 U	0.001	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.001	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.001 U	0.001	0.0004 U
2, 3, 4, 6, 7, 8-HxCDF	0.001	0.0001	0.0005 U
1, 2, 3, 7, 8, 9-HxCDF	0.0004 U	0.0004	0.001 U
HxCDFs (total)	0.003	0.0002	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.003	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.0004 U	0.0004	0.001 U
HpCDFs (total)	0.003	0.0003	0.001
OCDF	0.005	0.001	0.002
Toxic Equivalent (TEQ)	0.0003		0.003

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R2	LAB NUMBER(S):	1452, 3499-0003-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.348	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	128585	dscf/min
SAMPLE TIMES:	1117-1435	OXYGEN (%):	10.4	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 2 ng/m^3 @ 7% O_2	DL Run 2 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.009	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.004	0.0004	0.0005 U
PeCDDs (total)	0.029	0.0004	0.0005 U
1, 2, 3, 4, 7, 8-HxCDD	0.009	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.010	0.001	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.012	0.001	0.001 U
HxCDDs (total)	0.115	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.130	0.0004	0.002
HpCDDs (total)	0.233	0.0004	0.003
OCDD	0.870 M	0.0004 E	0.013 M
FURANS			
2, 3, 7, 8-TCDF	0.002	0.001	0.007
TCDFs (total)	0.051	0.001	0.043
1, 2, 3, 7, 8-PeCDF	0.008	0.0006	0.002
2, 3, 4, 7, 8-PeCDF	0.012	0.0006	0.004
PeCDFs (total)	0.119	0.001	0.017
1, 2, 3, 4, 7, 8-HxCDF	0.034	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.031	0.0001	0.0004 U
2, 3, 4, 6, 7, 8-HxCDF	0.071	0.0001	0.0005 U
1, 2, 3, 7, 8, 9-HxCDF	0.013	0.0002	0.001 U
HxCDFs (total)	0.348	0.0002	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.364	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.040	0.0003	0.001 U
HpCDFs (total)	0.514	0.0003	0.001
OCDF	0.304	0.001	0.002
Toxic Equivalent (TEQ)	0.034		0.003

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R4	LAB NUMBER(S):	1453, 3499-0004-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.422	dscm
SAMPLE DATE:	March 26, 1997	AIRFLOW:	129390	dscf/min
SAMPLE TIMES:	1303-1613	OXYGEN (%):	9.7	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 4 ng/m^3 @ 7% O_2	DL Run 4 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.001 U	0.001	0.001 U
TCDDs (total)	0.002	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.0004 U	0.0004	0.0004 U
PeCDDs (total)	0.003	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.001 U	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.001 U	0.001	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.0005 U	0.0005	0.001 U
HxCDDs (total)	0.005	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.003	0.0004	0.001
HpCDDs (total)	0.005	0.0004	0.003
OCDD	0.025 M	0.0004 E	0.012 M
FURANS			
2, 3, 7, 8-TCDF	0.001 U	0.001	0.007
TCDFs (total)	0.005	0.001	0.040
1, 2, 3, 7, 8-PeCDF	0.001 U	0.0006	0.001
2, 3, 4, 7, 8-PeCDF	0.001 U	0.0006	0.003
PeCDFs (total)	0.001 U	0.001	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.0003 U	0.0003	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.0003 U	0.0003	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.0005	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.0004 U	0.0004	0.001 U
HxCDFs (total)	0.001	0.0001	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.002	0.0001	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.0002 U	0.0002	0.001 U
HpCDFs (total)	0.004	0.0002	0.001
OCDF	0.004	0.001	0.002
Toxic Equivalent (TEQ)	0.0001		0.003

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R5	LAB NUMBER(S):	1454, 3499-0005-SA	
CLIENT:	Ash Grove Cement Company		-0001-SA	
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.872	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	103104	dscf/min
SAMPLE TIMES:	0700-1011	OXYGEN (%):	7.8	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 5 ng/m^3 @ 7% O_2	DL Run 5 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.005	0.001	0.001 U
TCDDs (total)	1.11	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.007	0.0003	0.0004 U
PeCDDs (total)	0.225	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.006	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.007	0.001	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.004	0.0005	0.001 U
HxCDDs (total)	0.196	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.024	0.0004	0.001
HpCDDs (total)	0.052	0.0004	0.003
OCDD	0.052 M	0.0004 E	0.013 M
FURANS			
2, 3, 7, 8-TCDF	0.031	0.001	0.007
TCDFs (total)	2.99	0.001	0.041
1, 2, 3, 7, 8-PeCDF	0.005	0.0006	0.001
2, 3, 4, 7, 8-PeCDF	0.007	0.0006	0.003
PeCDFs (total)	0.085	0.001	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.004	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.002	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.003	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.001	0.0002	0.001 U
HxCDFs (total)	0.024	0.0002	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.008	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.002	0.0003	0.001 U
HpCDFs (total)	0.013	0.0003	0.001
OCDF	0.009	0.001	0.002
Toxic Equivalent (TEQ)	0.018		0.003

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R6	LAB NUMBER(S):	1455, 3499-0006-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.736	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	99675	dscf/min
SAMPLE TIMES:	1045-1356	OXYGEN (%):	7.0	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 6 ng/m^3 @ 7% O_2	DL Run 6 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.008	0.001	0.001 U
TCDDs (total)	1.86	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.013	0.0003	0.0004 U
PeCDDs (total)	0.621	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.009	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.008	0.001	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.005	0.0005	0.001 U
HxCDDs (total)	0.289	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.026	0.0004	0.001
HpCDDs (total)	0.055	0.0004	0.003
OCDD	0.044 M	0.0004 E	0.012 M
FURANS			
2, 3, 7, 8-TCDF	0.073	0.001	0.007
TCDFs (total)	7.31	0.001	0.040
1, 2, 3, 7, 8-PeCDF	0.009	0.0005	0.001
2, 3, 4, 7, 8-PeCDF	0.012	0.0005	0.003
PeCDFs (total)	0.355	0.001	0.016
1, 2, 3, 4, 7, 8-HxCDF	0.004	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.003	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.003	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.001	0.0001	0.001 U
HxCDFs (total)	0.033	0.0001	0.003
1, 2, 3, 4, 6, 7, 8-HpCDF	0.008	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.001	0.0002	0.001 U
HpCDFs (total)	0.012	0.0002	0.001
OCDF	0.005	0.001	0.002
Toxic Equivalent (TEQ)	0.032		0.003

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION CONCENTRATION RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R7	LAB NUMBER(S):	1456, 3499-0007-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.708	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	98400	dscf/min
SAMPLE TIMES:	1455-1806	OXYGEN (%):	6.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 7 ng/m^3 @ 7% O_2	DL Run 7 ng/m^3 @ 7% O_2	Field Blank ng/m^3 @ 7% O_2
DIOXINS			
2, 3, 7, 8-TCDD	0.009	0.001	0.001 U
TCDDs (total)	1.98	0.001	0.001 U
1, 2, 3, 7, 8-PeCDD	0.016	0.0003	0.0004 U
PeCDDs (total)	0.728	0.0003	0.0004 U
1, 2, 3, 4, 7, 8-HxCDD	0.011	0.001	0.001 U
1, 2, 3, 6, 7, 8-HxCDD	0.010	0.000	0.001 U
1, 2, 3, 7, 8, 9-HxCDD	0.008	0.0005	0.001 U
HxCDDs (total)	0.333	0.001	0.001 U
1,2,3,4,6,7,8-HpCDD	0.045	0.0004	0.001
HpCDDs (total)	0.094	0.0004	0.003
OCDD	0.180 M	0.0004 E	0.012 M
FURANS			
2, 3, 7, 8-TCDF	0.066	0.001	0.006
TCDFs (total)	6.24	0.001	0.038
1, 2, 3, 7, 8-PeCDF	0.011	0.0005	0.001
2, 3, 4, 7, 8-PeCDF	0.015	0.0005	0.003
PeCDFs (total)	0.347	0.001	0.015
1, 2, 3, 4, 7, 8-HxCDF	0.011	0.0001	0.001
1, 2, 3, 6, 7, 8-HxCDF	0.009	0.0001	0.0003 U
2, 3, 4, 6, 7, 8-HxCDF	0.017	0.0001	0.0004 U
1, 2, 3, 7, 8, 9-HxCDF	0.004	0.0001	0.0005 U
HxCDFs (total)	0.101	0.0001	0.002
1, 2, 3, 4, 6, 7, 8-HpCDF	0.073	0.0002	0.001
1, 2, 3, 4, 7, 8, 9-HpCDF	0.010	0.0002	0.0005 U
HpCDFs (total)	0.111	0.0002	0.001
OCDF	0.066	0.001	0.002
Toxic Equivalent (TEQ)	0.033		0.002

ng/m^3 @ 7% O_2 = nanograms of analyte collected per dry standard cubic meter of gas sampled, corrected to 7% oxygen.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte was detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R1	LAB NUMBER(S):	1451, 3499-0002-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.418	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	131543	dscf/min
SAMPLE TIMES:	0700-1013	OXYGEN (%):	10.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 1 mg/hr	DL Run 1 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	0.216 U	0.216	0.183 U
TCDDs (total)	0.490	0.177	0.196 U
1, 2, 3, 7, 8-PeCDD	0.085 U	0.085	0.078 U
PeCDDs (total)	0.615	0.060	0.078 U
1, 2, 3, 4, 7, 8-HxCDD	0.131 U	0.131	0.157 U
1, 2, 3, 6, 7, 8-HxCDD	0.118 U	0.118	0.144 U
1, 2, 3, 7, 8, 9-HxCDD	0.111 U	0.111	0.137 U
HxCDDs (total)	0.916	0.105	0.157 U
1,2,3,4,6,7,8-HpCDD	0.530	0.072	0.255
HpCDDs (total)	0.981	0.072	0.490
OCDD	3.79 M	0.072 E	2.22 M
FURANS			
2, 3, 7, 8-TCDF	0.144 U	0.144	1.18
TCDFs (total)	1.90	0.098	7.19
1, 2, 3, 7, 8-PeCDF	0.085 U	0.085	0.262
2, 3, 4, 7, 8-PeCDF	0.085 U	0.085	0.608
PeCDFs (total)	0.105 U	0.105	2.81
1, 2, 3, 4, 7, 8-HxCDF	0.137	0.024	0.177
1, 2, 3, 6, 7, 8-HxCDF	0.092 U	0.092	0.061 U
2, 3, 4, 6, 7, 8-HxCDF	0.150	0.023	0.078 U
1, 2, 3, 7, 8, 9-HxCDF	0.065 U	0.065	0.092 U
HxCDFs (total)	0.510	0.027	0.458
1, 2, 3, 4, 6, 7, 8-HpCDF	0.504	0.034	0.216
1, 2, 3, 4, 7, 8, 9-HpCDF	0.065 U	0.065	0.092 U
HpCDFs (total)	0.504	0.044	0.216
OCDF	0.850	0.131	0.334
Toxic Equivalent (TEQ)	0.044		0.458

mg/hour = milligrams of analyte emitted per hour.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R2	LAB NUMBER(S):	1452, 3499-0003-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.348	dscm
SAMPLE DATE:	March 25, 1997	AIRFLOW:	128585	dscf/min
SAMPLE TIMES:	1117-1435	OXYGEN (%):	10.4	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 2 mg/hr	DL Run 2 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	0.183 U	0.185	0.183 U
TCDDs (total)	1.44	0.176	0.196 U
1, 2, 3, 7, 8-PeCDD	0.718	0.059	0.078 U
PeCDDs (total)	4.83	0.059	0.078 U
1, 2, 3, 4, 7, 8-HxCDD	1.50	0.104	0.157 U
1, 2, 3, 6, 7, 8-HxCDD	1.70	0.091	0.144 U
1, 2, 3, 7, 8, 9-HxCDD	2.02	0.091	0.137 U
HxCDDs (total)	18.9	0.104	0.157 U
1,2,3,4,6,7,8-HpCDD	21.5	0.072	0.255
HpCDDs (total)	38.5	0.072	0.489
OCDD	143.6 M	0.072 E	2.22 M
FURANS			
2, 3, 7, 8-TCDF	0.411	0.098	1.17
TCDFs (total)	8.48	0.098	7.18
1, 2, 3, 7, 8-PeCDF	1.24	0.098	0.261
2, 3, 4, 7, 8-PeCDF	2.02	0.098	0.607
PeCDFs (total)	19.6	0.098	2.81
1, 2, 3, 4, 7, 8-HxCDF	5.68	0.023	0.176
1, 2, 3, 6, 7, 8-HxCDF	5.16	0.018	0.061 U
2, 3, 4, 6, 7, 8-HxCDF	11.7	0.023	0.078 U
1, 2, 3, 7, 8, 9-HxCDF	2.22	0.027	0.091 U
HxCDFs (total)	57.4	0.027	0.457
1, 2, 3, 4, 6, 7, 8-HpCDF	60.0	0.034	0.215
1, 2, 3, 4, 7, 8, 9-HpCDF	6.53	0.044	0.091 U
HpCDFs (total)	84.8	0.044	0.215
OCDF	50.3	0.131	0.333
Toxic Equivalent (TEQ)	5.55		0.457

mg/hour = milligrams of analyte emitted per hour.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R4	LAB NUMBER(S):	1453, 3499-0004-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	3.422	dscm
SAMPLE DATE:	March 26, 1997	AIRFLOW:	129390	dscf/min
SAMPLE TIMES:	1303-1613	OXYGEN (%):	9.7	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 4 mg/hr	DL Run 4 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	0.122 U	0.122	0.180 U
TCDDs (total)	0.360	0.173	0.193 U
1, 2, 3, 7, 8-PeCDD	0.064 U	0.064	0.077 U
PeCDDs (total)	0.514	0.058	0.077 U
1, 2, 3, 4, 7, 8-HxCDD	0.096 U	0.096	0.154 U
1, 2, 3, 6, 7, 8-HxCDD	0.122 U	0.122	0.141 U
1, 2, 3, 7, 8, 9-HxCDD	0.084 U	0.084	0.135 U
HxCDDs (total)	0.900	0.103	0.154 U
1,2,3,4,6,7,8-HpCDD	0.553	0.071	0.251
HpCDDs (total)	0.964	0.071	0.482
OCDD	4.37 M	0.071 E	2.18 M
FURANS			
2, 3, 7, 8-TCDF	0.154 U	0.154	1.16
TCDFs (total)	0.835	0.096	7.07
1, 2, 3, 7, 8-PeCDF	0.109 U	0.109	0.257
2, 3, 4, 7, 8-PeCDF	0.103 U	0.103	0.598
PeCDFs (total)	0.109 U	0.109	2.76
1, 2, 3, 4, 7, 8-HxCDF	0.053 U	0.053	0.173
1, 2, 3, 6, 7, 8-HxCDF	0.055 U	0.055	0.060 U
2, 3, 4, 6, 7, 8-HxCDF	0.084	0.026	0.077 U
1, 2, 3, 7, 8, 9-HxCDF	0.064 U	0.064	0.090 U
HxCDFs (total)	0.212	0.022	0.450
1, 2, 3, 4, 6, 7, 8-HpCDF	0.386	0.026	0.212
1, 2, 3, 4, 7, 8, 9-HpCDF	0.044 U	0.044	0.090 U
HpCDFs (total)	0.707	0.044	0.212
OCDF	0.636	0.129	0.328
Toxic Equivalent (TEQ)	0.022		0.450

mg/hour = milligrams of analyte emitted per hour.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R5	LAB NUMBER(S):	1454, 3499-0005-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.872	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	103104	dscf/min
SAMPLE TIMES:	0700-1011	OXYGEN (%):	7.8	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 5 mg/hr	DL Run 5 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	0.854	0.146	0.171 U
TCDDs (total)	183.0	0.165	0.183 U
1, 2, 3, 7, 8-PeCDD	1.22	0.056	0.073 U
PeCDDs (total)	37.2	0.056	0.073 U
1, 2, 3, 4, 7, 8-HxCDD	0.976	0.098	0.146 U
1, 2, 3, 6, 7, 8-HxCDD	1.10	0.085	0.134 U
1, 2, 3, 7, 8, 9-HxCDD	0.732	0.085	0.128 U
HxCDDs (total)	32.3	0.098	0.146 U
1,2,3,4,6,7,8-HpCDD	3.97	0.067	0.238
HpCDDs (total)	8.54	0.067	0.458
OCDD	8.54 M	0.067 E	2.07 M
FURANS			
2, 3, 7, 8-TCDF	5.06	0.092	1.10
TCDFs (total)	494.1	0.092	6.71
1, 2, 3, 7, 8-PeCDF	0.854	0.092	0.244
2, 3, 4, 7, 8-PeCDF	1.10	0.092	0.567
PeCDFs (total)	14.0	0.092	2.62
1, 2, 3, 4, 7, 8-HxCDF	0.604	0.022	0.165
1, 2, 3, 6, 7, 8-HxCDF	0.397	0.017	0.057 U
2, 3, 4, 6, 7, 8-HxCDF	0.531	0.021	0.073 U
1, 2, 3, 7, 8, 9-HxCDF	0.165	0.025	0.085 U
HxCDFs (total)	4.03	0.025	0.427
1, 2, 3, 4, 6, 7, 8-HpCDF	1.34	0.032	0.201
1, 2, 3, 4, 7, 8, 9-HpCDF	0.397	0.041	0.085 U
HpCDFs (total)	2.14	0.041	0.201
OCDF	1.46	0.122	0.311
Toxic Equivalent (TEQ)	3.05		0.427

mg/hour = milligrams of analyte emitted per hour.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R6	LAB NUMBER(S):	1455, 3499-0006-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.736	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	99675	dscf/min
SAMPLE TIMES:	1045-1356	OXYGEN (%):	7.0	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 6 mg/hr	DL Run 6 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	1.36	0.149	0.173 U
TCDDs (total)	315.7	0.167	0.186 U
1, 2, 3, 7, 8-PeCDD	2.23	0.056	0.074 U
PeCDDs (total)	105.2	0.056	0.074 U
1, 2, 3, 4, 7, 8-HxCDD	1.49	0.099	0.149 U
1, 2, 3, 6, 7, 8-HxCDD	1.36	0.087	0.136 U
1, 2, 3, 7, 8, 9-HxCDD	0.929	0.087	0.130 U
HxCDDs (total)	48.9	0.099	0.149 U
1,2,3,4,6,7,8-HpCDD	4.40	0.068	0.241
HpCDDs (total)	9.29	0.068	0.464
OCDD	7.43 M	0.068 E	2.10 M
FURANS			
2, 3, 7, 8-TCDF	12.4	0.093	1.11
TCDFs (total)	1238	0.093	6.81
1, 2, 3, 7, 8-PeCDF	1.55	0.093	0.248
2, 3, 4, 7, 8-PeCDF	2.04	0.093	0.576
PeCDFs (total)	60.0	0.093	2.66
1, 2, 3, 4, 7, 8-HxCDF	0.619	0.022	0.167
1, 2, 3, 6, 7, 8-HxCDF	0.477	0.017	0.058 U
2, 3, 4, 6, 7, 8-HxCDF	0.582	0.022	0.074 U
1, 2, 3, 7, 8, 9-HxCDF	0.161	0.025	0.087 U
HxCDFs (total)	5.63	0.025	0.433
1, 2, 3, 4, 6, 7, 8-HpCDF	1.30	0.032	0.204
1, 2, 3, 4, 7, 8, 9-HpCDF	0.198	0.042	0.087 U
HpCDFs (total)	2.04	0.042	0.204
OCDF	0.867	0.124	0.316
Toxic Equivalent (TEQ)	5.45		0.433

mg/hour = milligrams of analyte emitted per hour.
U = undetected at specified detection limit (DL).
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

EMISSION RATE RESULTS
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\DF\R7	LAB NUMBER(S):	1456, 3499-0007-SA	
CLIENT:	Ash Grove Cement Company			-0001-SA
LOCATION:	Seattle, Washington	SAMPLE VOLUME:	2.708	dscm
SAMPLE DATE:	March 27, 1997	AIRFLOW:	98400	dscf/min
SAMPLE TIMES:	1455-1806	OXYGEN (%):	6.1	

	MAIN CEMENT KILN STACK		
ANALYTE	Run 7 mg/hr	DL Run 7 mg/hr	Field Blank mg/hr
DIOXINS			
2, 3, 7, 8-TCDD	1.61	0.148	0.173 U
TCDDs (total)	351.9	0.167	0.185 U
1, 2, 3, 7, 8-PeCDD	2.78	0.056	0.074 U
PeCDDs (total)	129.7	0.056	0.074 U
1, 2, 3, 4, 7, 8-HxCDD	2.04	0.099	0.148 U
1, 2, 3, 6, 7, 8-HxCDD	1.85	0.086	0.136 U
1, 2, 3, 7, 8, 9-HxCDD	1.48	0.086	0.130 U
HxCDDs (total)	59.3	0.099	0.148 U
1,2,3,4,6,7,8-HpCDD	8.03	0.068	0.241
HpCDDs (total)	16.7	0.068	0.463
OCDD	32.1 M	0.068 E	2.10 M
FURANS			
2, 3, 7, 8-TCDF	11.7	0.093	1.11
TCDFs (total)	1111	0.093	6.79
1, 2, 3, 7, 8-PeCDF	1.98	0.093	0.247
2, 3, 4, 7, 8-PeCDF	2.59	0.093	0.574
PeCDFs (total)	61.7	0.093	2.66
1, 2, 3, 4, 7, 8-HxCDF	1.91	0.022	0.167
1, 2, 3, 6, 7, 8-HxCDF	1.67	0.017	0.057 U
2, 3, 4, 6, 7, 8-HxCDF	2.96	0.022	0.074 U
1, 2, 3, 7, 8, 9-HxCDF	0.679	0.025	0.086 U
HxCDFs (total)	17.9	0.025	0.432
1, 2, 3, 4, 6, 7, 8-HpCDF	13.0	0.032	0.204
1, 2, 3, 4, 7, 8, 9-HpCDF	1.73	0.042	0.086 U
HpCDFs (total)	19.8	0.042	0.204
OCDF	11.7	0.123	0.315
Toxic Equivalent (TEQ)	5.93		0.432

mg/hour = milligrams of analyte emitted per hour.
E = detection limit estimated; analyte present in both the field and method blanks.
M = analyte detected in the method blank.

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\101AR1	LAB #:	1457
CLIENT:	Ash Grove Cement Company	START TIME:	0700 hours
LOCATION:	Seattle, Washington	STOP TIME:	0910 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 25, 1997		
RUN #:	1 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
761.7	575.6	186.1
680.3	648.0	32.3
683.1	677.3	5.8
542.0	539.7	2.3
810.4	791.6	18.8

TOTAL H2O GAIN:	245.3	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	11.57	NOZZLE DIAMETER:	0.353 inches
PERCENT MOISTURE:	12.00	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1200	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	440.228	METER TEMPERATURE:	60.0 degrees F
FINAL METER VOLUME:	524.997	BAROMETRIC PRES.:	30.05 inches Hg
VOLUME SAMPLED:	84.769	STATIC PRESSURE:	-0.50 inches H2O
STD VOLUME (dscf):	84.786	STACK PRESSURE:	30.01 inches Hg
STD VOLUME (dscm):	2.401	ORIFICE PRESSURE:	2.006 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.20 inches Hg
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	0.995	AVERAGE CONC. CO2:	18.7 percent
PERCENT ERROR (%):	1.9	AVERAGE CONC. O2:	10.1 percent
		MOLECULAR WEIGHT:	31.40 g/g-mole-dry
		MOLECULAR WEIGHT:	29.79 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
SW	3	0.19	227	NE	3	0.21	229
	2	0.18	231		2	0.21	232
	1	0.12	227		1	0.12	228
SE	3	0.20	227	NW	3	0.18	230
	2	0.18	230		2	0.19	231
	1	0.13	227		1	0.15	228

PERCENT ISOKINETICS:	99 %		
STACK GAS TEMPERATURE:	228.9 degrees F		688.9 degrees R
AVERAGE VELOCITY HEAD:	0.170 inches H2O		
STACK GAS VELOCITY:			26.0 ft/sec
STACK GAS AIR FLOW:	207044 acf/min		140070 dscf/min

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\101AR2	LAB #:	1458
CLIENT:	Ash Grove Cement Company	START TIME:	1045 hours
LOCATION:	Seattle, Washington	STOP TIME:	1327 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 25, 1997		
RUN #:	2 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
795.6	596.8	198.8
678.3	645.5	32.8
655.7	657.4	-1.7
493.7	494.7	-1.0
878.0	851.3	26.7

TOTAL H2O GAIN:	255.6	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	12.05	NOZZLE DIAMETER:	0.353 inches
PERCENT MOISTURE:	12.99	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1299	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	525.519	METER TEMPERATURE:	72.7 degrees F
FINAL METER VDLUME:	608.262	BAROMETRIC PRES.:	30.05 inches Hg
VOLUME SAMPLED:	82.743	STATIC PRESSURE:	-0.48 inches H2O
STD VOLUME (dscf):	80.757	STACK PRESSURE:	30.01 inches Hg
STD VOLUME (dscm):	2.287	ORIFICE PRESSURE:	1.854 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.19 inches Hg
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	0.994	AVERAGE CONC. CO2:	18.1 percent
PERCENT ERROR (%):	1.8	AVERAGE CONC. O2:	10.3 percent
		MOLECULAR WEIGHT:	31.31 g/g-mole-dry
		MOLECULAR WEIGHT:	29.58 g/g-mole-wet

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
NW	3	0.17	229	SE	3	0.19	228
	2	0.17	229		2	0.16	229
	1	0.11	225		1	0.12	224
NE	1	0.18	226	SW	3	0.19	224
	2	0.17	228		2	0.16	220
	1	0.13	226		1	0.11	218

PERCENT ISOKINETICS:	99 %	
STACK GAS TEMPERATURE:	225.5 degrees F	685.5 degrees R
AVERAGE VELOCITY HEAD:	0.154 inches H2O	
STACK GAS VELOCITY:		24.7 ft/sec
STACK GAS AIR FLOW:	196960 acf/min	132425 dscf/min

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\101AR4	LAB #:	1459
CLIENT:	Ash Grove Cement Company	START TIME:	1313 hours
LOCATION:	Seattle, Washington	STOP TIME:	1554 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 26, 1997		
RUN #:	4 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
772.1	598.0	174.1
679.1	650.7	28.4
665.3	660.4	4.9
495.6	495.1	0.5
859.3	840.9	18.4

TOTAL H2O GAIN:	226.3	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	10.67	NOZZLE DIAMETER:	0.353 inches
PERCENT MOISTURE:	11.67	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.1167	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
		METER TEMPERATURE:	63.8 degrees F
		BAROMETRIC PRES.:	29.80 inches Hg
		STATIC PRESSURE:	-0.46 inches H2O
		STACK PRESSURE:	29.77 inches Hg
		ORIFICE PRESSURE:	1.843 inches H2O
		METER PRESSURE:	29.94 inches Hg
INIT. METER VOLUME:	637.843	AVERAGE CONC. CO2:	19.8 percent
FINAL METER VOLUME:	719.869	AVERAGE CONC. O2:	9.7 percent
VOLUME SAMPLED:	82.026	MOLECULAR WEIGHT:	31.56 g/g-mole-dry
STD VOLUME (dscf):	80.741	MOLECULAR WEIGHT:	29.97 g/g-mole-wet
STD VOLUME (dscm):	2.287		
Y FACTOR:	0.976		
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	0.991		
PERCENT ERROR (%):	1.5		

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
SW	3	0.18	251	NE	3	0.17	226
	2	0.17	246		2	0.14	225
	1	0.12	241		1	0.11	223
SE	1	0.17	239	NW	1	0.18	222
	2	0.16	238		2	0.17	223
	1	0.13	233		1	0.18	220

PERCENT ISOKINETICS:	99 %	
STACK GAS TEMPERATURE:	232.3 degrees F	692.3 degrees R
AVERAGE VELOCITY HEAD:	0.156 inches H2O	
STACK GAS VELOCITY:		25.0 ft/sec
STACK GAS AIR FLOW:	198768 acf/min	133221 dscf/min

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\101AR5	LAB #:	1460
CLIENT:	Ash Grove Cement Company	START TIME:	0700 hours
LOCATION:	Seattle, Washington	STOP TIME:	0923 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 27, 1997		
RUN #:	5 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
709.4	596.2	113.2
674.8	655.8	19.0
666.7	663.7	3.0
548.9	548.7	0.2
879.1	868.6	10.5

TOTAL H2O GAIN:	145.9	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	6.88	NOZZLE DIAMETER:	0.353 inches
PERCENT MOISTURE:	9.35	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.0935	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	720.248	METER TEMPERATURE:	56.8 degrees F
FINAL METER VOLUME:	786.785	BAROMETRIC PRES.:	30.00 inches Hg
VOLUME SAMPLED:	66.537	STATIC PRESSURE:	-0.65 inches H2O
STD VOLUME (dscf):	66.731	STACK PRESSURE:	29.95 inches Hg
STD VOLUME (dscm):	1.890	ORIFICE PRESSURE:	1.268 inches H2O
Y FACTOR:	0.976	METER PRESSURE:	30.09 inches Hg
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	0.998	AVERAGE CONC. CO2:	22.5 percent
PERCENT ERROR (%):	2.2	AVERAGE CONC. O2:	8.1 percent
		MOLECULAR WEIGHT:	31.92 g/g-mole-dry
		MOLECULAR WEIGHT:	30.62 g/g-mole-wet

	SAMPLE POINT	VELOCITY " H2O	TEMPERATURE °F		SAMPLE POINT	VELOCITY " H2O	TEMPERATURE °F
SW	3	0.14	364	NE	3	0.13	410
	2	0.16	368		2	0.14	414
	1	0.06	366		1	0.09	407
SE	1	0.14	386	NW	1	0.13	422
	2	0.14	392		2	0.13	422
	1	0.08	385		1	0.07	414

PERCENT ISOKINETICS:	104 %	
STACK GAS TEMPERATURE:	395.8 degrees F	855.8 degrees R
AVERAGE VELOCITY HEAD:	0.115 inches H2O	
STACK GAS VELOCITY:		23.5 ft/sec
STACK GAS AIR FLOW:	187399 acf/min	104923 dscf/min

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\I01AR6	LAB #:	1461
CLIENT:	Ash Grove Cement Company	START TIME:	1045 hours
LOCATION:	Seattle, Washington	STOP TIME:	1259 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 27, 1997		
RUN #:	6 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
713.4	602.7	110.7
667.5	648.7	18.8
675.2	670.8	4.4
536.0	536.0	0.0
820.0	809.5	10.5
TOTAL H2O GAIN:		144.4
TOTAL VOLUME (scf):		6.81
PERCENT MOISTURE:		9.48
Bws:		0.0948

PITOT TUBE Cp:	0.84		
NOZZLE DIAMETER:	0.353	inches	
NOZZLE AREA:	0.0007	sq. feet	
STACK DIAMETER:	156	inches	
STACK AREA:	132.7	sq. feet	
METER TEMPERATURE:	61.8	degrees F	
BAROMETRIC PRES.:	30.00	inches Hg	
STATIC PRESSURE:	-0.65	inches H2O	
STACK PRESSURE:	29.95	inches Hg	
ORIFICE PRESSURE:	1.213	inches H2O	
METER PRESSURE:	30.09	inches Hg	
INIT. METER VOLUME:	787.321		
FINAL METER VOLUME:	852.793		
VOLUME SAMPLED:	65.472		
STD VOLUME (dscf):	65.025		
STD VOLUME (dscm):	1.842		
Y FACTOR:	0.976		
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	1.001		
PERCENT ERROR (%):	2.5		
AVERAGE CONC. CO2:	21.3	percent	
AVERAGE CONC. O2:	7.3	percent	
MOLECULAR WEIGHT:	31.70	g/g-mole-dry	
MOLECULAR WEIGHT:	30.40	g/g-mole-wet	

SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H2O	TEMPERATURE °F
SW	3	0.13	426	NE	3	0.14	427
	2	0.13	427		2	0.12	435
	1	0.09	418		1	0.10	419
SE	3	0.15	425	NW	3	0.15	427
	2	0.11	431		2	0.13	430
	1	0.09	423		1	0.07	409

PERCENT ISOKINETICS:	102 %		
STACK GAS TEMPERATURE:	424.8	degrees F	884.8 degrees R
AVERAGE VELOCITY HEAD:	0.116	inches H2O	
STACK GAS VELOCITY:			24.1 ft/sec
STACK GAS AIR FLOW:	192105	acf/min	103890 dscf/min

METHODS 1, 2, 3A, 4 AND 101A
AM TEST-AIR QUALITY, LLC

FILE NAME:	JAA\97-043WD\101AR7	LAB #:	1462
CLIENT:	Ash Grove Cement Company	START TIME:	1450 hours
LOCATION:	Seattle, Washington	STOP TIME:	1710 hours
SAMPLE SITE:	Cement Kiln Main Stack	SAMPLE LENGTH:	120.0 minutes
SAMPLE DATE:	March 27, 1997		
RUN #:	7 - Method 4/101A		
OPERATOR:	Lawrence		

IMPINGER WEIGHTS

FINAL	INITIAL	NET
686.4	577.7	108.7
676.8	652.0	24.8
682.4	677.3	5.1
540.6	540.6	0.0
817.4	805.5	11.9

TOTAL H2O GAIN:	150.5	PITOT TUBE Cp:	0.84
TOTAL VOLUME (scf):	7.10	NOZZLE DIAMETER:	0.353 inches
PERCENT MOISTURE:	9.80	NOZZLE AREA:	0.0007 sq. feet
Bws:	0.0980	STACK DIAMETER:	156 inches
		STACK AREA:	132.7 sq. feet
INIT. METER VOLUME:	853.250	METER TEMPERATURE:	65.8 degrees F
FINAL METER VOLUME:	919.498	BAROMETRIC PRES.:	30.00 inches Hg
VOLUME SAMPLED:	66.248	STATIC PRESSURE:	-0.65 inches H20
STD VOLUME (dscf):	65.299	STACK PRESSURE:	29.95 inches Hg
STD VOLUME (dscm):	1.849	ORIFICE PRESSURE:	1.237 inches H20
Y FACTOR:	0.976	METER PRESSURE:	30.09 inches Hg
DELTA H @:	2.060		
Y FACTOR CAL. CHECK:	0.994	AVERAGE CONC. CO2:	24.8 percent
PERCENT ERROR (%):	1.9	AVERAGE CONC. O2:	6.0 percent
		MOLECULAR WEIGHT:	32.21 g/g-mole-dry
		MOLECULAR WEIGHT:	30.82 g/g-mole-wet

SAMPLE POINT		VELOCITY " H20	TEMPERATURE °F	SAMPLE POINT		VELOCITY " H20	TEMPERATURE °F
SW	3	0.13	431	NE	3	0.13	425
	2	0.13	430		2	0.13	442
	1	0.09	425		1	0.09	436
SE	1	0.14	426	NW	1	0.11	439
	2	0.13	437		2	0.11	436
	1	0.09	424		1	0.07	425

PERCENT ISOKINETICS:	106 %		
STACK GAS TEMPERATURE:	431.3 degrees F		891.3 degrees R
AVERAGE VELOCITY HEAD:	0.111 inches H20		
STACK GAS VELOCITY:			23.6 ft/sec
STACK GAS AIR FLOW:	187564 acf/min		100325 dscf/min

MERCURY EMISSIONS RESULTS
Am Test-Air Quality, LLC

File Name: JAA\97-043WD\HG\R1-4
Client: Ash Grove Cement Company
Location: Seattle, Washington
Sample Location: Cement Kiln Main Stack

Sample Date: 3/25/97
Sample Time: 0700-0910
Lab Numbers: 1457, 97-A04268
Run Number: 1

Sample Volume: 2.401 dscm
Airflow: 140070 dscf/min
Oxygen: 10.1 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	0.32	40	133.3	16660	171.5	21442	31.7	3965

Sample Date: 3/25/97
Sample Time: 1045-1327
Lab Numbers: 1458, 97-A04269
Run Number: 2

Sample Volume: 2.287 dscm
Airflow: 132425 dscf/min
Oxygen: 10.3 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	0.295	41	129.0	17927	169.1	23509	29.0	4034

Sample Date: 3/26/97
Sample Time: 1313-1554
Lab Numbers: 1459, 97-A04270
Run Number: 4

Sample Volume: 2.287 dscm
Airflow: 133221 dscf/min
Oxygen: 9.7 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	0.32	38	139.9	16616	173.7	20621	31.7	3761

ug = micrograms
ng/dscm @ 7% O_2 = nanograms of analyte per dry standard cubic meter, corrected to 7% oxygen.
ng/dscm = nanograms of analyte per dry standard cubic meter.
mg/hr = milligrams of analyte emitted per hour.

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AGCS2M003224

MERCURY EMISSIONS RESULTS
Am Test-Air Quality, LLC

File Name: JAA\97-043WD\HG\R5-7
Client: Ash Grove Cement Company
Location: Seattle, Washington
Sample Location: Cement Kiln Main Stack

Sample Date: 3/27/97
Sample Time: 0700-0923
Lab Numbers: 1460, 97-A04271
Run Number: 5

Sample Volume: 1.890 dscm
Airflow: 104923 dscf/min
Oxygen: 8.1 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	3.0	1500	1587	793651	1724	861855	283.0	141499

Sample Date: 3/27/97
Sample Time: 1045-1259
Lab Numbers: 1461, 97-A04272
Run Number: 6

Sample Volume: 1.842 dscm
Airflow: 103890 dscf/min
Oxygen: 7.3 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	3.1	1500	1683	814332	1720	832295	297.1	143757

Sample Date: 3/27/97
Sample Time: 1450-1710
Lab Numbers: 1462, 97-A04273
Run Number: 7

Sample Volume: 1.849 dscm
Airflow: 100325 dscf/min
Oxygen: 6.0 percent

	EMISSION CONCENTRATION						EMISSION RATE	
Analyte	Detection Limit µg	µg	Detection Limit ng/dscm	ng/dscm	Detection Limit ng/dscm @ 7% O_2	ng/dscm @ 7% O_2	Detection Limit mg/hr	mg/hr
Mercury	3.15	1500	1704	811249	1589	756803	290.4	138298

ug = micrograms
ng/dscm @ 7% O_2 = nanograms of analyte per dry standard cubic meter, corrected to 7% oxygen.

ng/dscm = nanograms of analyte per dry standard cubic meter.
mg/hr = milligrams of analyte emitted per hour.

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AGCS2M003225

APPENDIX B

Laboratory Analysis Results

ALTA

April 15, 1997

Alta Batch I.D.: 3499

Ms. Judy Aasland
Amtest, Inc.
30545 Southeast 84th Street, Suite 5
Preston, WA 98050

Dear Ms. Aasland,

Enclosed are the results for the seven M23 trains received at Alta Analytical Laboratory on April 1, 1997. This work was authorized under your Project # 97-012. As per your request, the Trip Blank and the impinger contents for each train were put on hold. These trains were extracted and analyzed using EPA Method 23 for tetra to octa chlorinated dioxins/dibenzofurans using High Resolution Mass Spectrometry (HRMS). The 2,3,7,8-TCDF was confirmed on the DB-225 column. Results designated with the " D " qualifier should be considered maximum possible concentrations due to chlorinated diphenyl ether interferences. A standard turnaround time was requested for this work.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations, our current certifications, and copies of the raw data (if requested).

If you have any questions regarding this report please feel free to contact me.

Sincerely,

Robert S. Mitzel
Director of Air Toxics

Alta Analytical Laboratory Inc.
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762
FAX (916) 933-0940
(916) 933-1640

ALTA

Sample Inventory Report

Project No.: 3499 **Project Name:** General Analytical AIR
Date Rec.: 4/ 1/97

Lab. Sample ID	Client Sample ID	SGI Component Type
0001	M23-Field Blank	ACE/DCM
0001	M23-Field Blank	Filter
0001	M23-Field Blank	Impinger Catch
0001	M23-Field Blank	Toluene
0001	M23-Field Blank	Xad
0002	M23-R1	ACE/DCM
0002	M23-R1	Filter
0002	M23-R1	Impinger Catch
0002	M23-R1	Toluene
0002	M23-R1	Xad
0003	M23-R2	ACE/DCM
0003	M23-R2	Filter
0003	M23-R2	Impinger Catch
0003	M23-R2	Toluene
0003	M23-R2	Xad
0004	M23-R4	ACE/DCM
0004	M23-R4	Filter
0004	M23-R4	Impinger Catch
0004	M23-R4	Toluene
0004	M23-R4	Xad
0005	M23-R5	ACE/DCM
0005	M23-R5	Filter
0005	M23-R5	Impinger Catch
0005	M23-R5	Toluene
0005	M23-R5	Xad
0006	M23-R6	ACE/DCM
0006	M23-R6	Filter
0006	M23-R6	Impinger Catch
0006	M23-R6	Toluene
0006	M23-R6	Xad
0007	M23-R7	ACE/DCM
0007	M23-R7	Filter
0007	M23-R7	Impinger Catch
0007	M23-R7	Toluene
0007	M23-R7	Xad
0008	M23-Trip Blank	Xad

ALTA

SECTION II.

ALTA

PCDD & PCDF

EPA METHOD 23

Method Blank
Lab ID: 3499-MB
Matrix: M23
TEQ: 0.007

Date Received: NA
Date Extracted: 4/11/97
Sample Amount: Sample

ICAL ID: I428
QC Lot: LC0411M
Units: pg/sample

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	2.4			
Total TCDD	ND	2.7			
1,2,3,7,8-PeCDD	ND	0.91			
Total PeCDD	ND	0.91			
1,2,3,4,7,8-HxCDD	ND	1.6			
1,2,3,6,7,8-HxCDD	ND	1.4			
1,2,3,7,8,9-HxCDD	ND	1.4			
Total HxCDD	ND	1.6			
1,2,3,4,6,7,8-HpCDD	ND	1.1			
Total HpCDD	ND	1.1			
OCDD	7.0		0.93	8:1	A
2,3,7,8-TCDF	ND	1.5			
Total TCDF	ND	1.5			
1,2,3,7,8-PeCDF	ND	1.5			
2,3,4,7,8-PeCDF	ND	1.5			
Total PeCDF	ND	1.5			
1,2,3,4,7,8-HxCDF	ND	0.36			
1,2,3,6,7,8-HxCDF	ND	0.28			
2,3,4,6,7,8-HxCDF	ND	0.35			
1,2,3,7,8,9-HxCDF	ND	0.41			
Total HxCDF	ND	0.41			
1,2,3,4,6,7,8-HpCDF	ND	0.52			
1,2,3,4,7,8,9-HpCDF	ND	0.68			
Total HpCDF	ND	0.68			
OCDF	ND	2.0			

Analyst: [signature]

Reviewer: [signature]

ALTA

PCDD & PCDF
EPA METHOD 23

Method Blank
Lab ID: 3499-MB

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	93	0.80	
^{13}C-1,2,3,7,8-PeCDD	106	1.61	
^{13}C-1,2,3,6,7,8-HxCDD	86	1.29	
^{13}C-1,2,3,4,6,7,8-HpCDD	99	1.08	
^{13}C-OCDD	86	0.89	
^{13}C-2,3,7,8-TCDF	101	0.78	
^{13}C-1,2,3,7,8-PeCDF	114	1.54	
^{13}C-1,2,3,6,7,8-HxCDF	82	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	94	0.43	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	NA	NA	
^{13}C-2,3,4,7,8-PeCDF	NA	NA	
^{13}C-1,2,3,4,7,8-HxCDD	NA	NA	
^{13}C-1,2,3,4,7,8-HxCDF	NA	NA	
^{13}C-1,2,3,4,7,8,9-HpCDF	NA	NA	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	101	0.51	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** NA **SP-2331:** NA

Analyst: BM

Reviewer:

ALTA

PCDD & PCDF

EPA METHOD 23

LCS1/LCS2 RESULTS
Lab ID: 3499-LCS1/LCS2
Matrix: M23

Date Received: NA
Date Extracted: 4/11/97
Sample Amount: Sample

ICAL ID: I428
QC Lot: LC0411M
Units: NA

Compound	LCS1 %R	LCS2 %R	RPD %
2,3,7,8-TCDD	102	102	0.0
1,2,3,7,8-PeCDD	115	112	2.6
1,2,3,4,7,8-HxCDD	126	126	0.0
1,2,3,6,7,8-HxCDD	114	112	1.8
1,2,3,7,8,9-HxCDD	124	123	0.81
1,2,3,4,6,7,8-HpCDD	109	107	1.9
OCDD	107	104	2.8
2,3,7,8-TCDF	105	101	3.9
1,2,3,7,8-PeCDF	113	109	3.6
2,3,4,7,8-PeCDF	112	108	3.6
1,2,3,4,7,8-HxCDF	126	122	3.2
1,2,3,6,7,8-HxCDF	117	114	2.6
2,3,4,6,7,8-HxCDF	123	120	2.5
1,2,3,7,8,9-HxCDF	135	129	4.5
1,2,3,4,6,7,8-HpCDF	111	110	0.90
1,2,3,4,7,8,9-HpCDF	114	110	3.6
OCDF	108	104	3.8

Analyst: [signature]

Reviewer: [signature]

ALTA

PCDD & PCDF
EPA METHOD 23

LCS1/LCS2 RESULTS
Lab ID: 3499-LCS1/LCS2

Isotopic Recovery Results

Internal Standard:	LCS1 %R	LCS2 %R
^{13}C-2,3,7,8-TCDD	98	100
^{13}C-1,2,3,7,8-PeCDD	118	120
^{13}C-1,2,3,6,7,8-HxCDD	90	89
^{13}C-1,2,3,4,6,7,8-HpCDD	108	105
^{13}C-OCDD	97	90
^{13}C-2,3,7,8-TCDF	109	110
^{13}C-1,2,3,7,8-PeCDF	92	130
^{13}C-1,2,3,6,7,8-HxCDF	87	88
^{13}C-1,2,3,4,6,7,8-HpCDF	106	104

Dates Analyzed:

DB-5: 4/15/97 **DB-225:** NA **SP-2331:** NA

Analyst: _____ **Page 2 of 2** **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23 Field Blank	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0001-SA	**Date Extracted:**	4/11/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	7.0				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	2.8			
Total TCDD	ND	3.0			
1,2,3,7,8-PeCDD	ND	1.2			
Total PeCDD	ND	1.2			
1,2,3,4,7,8-HxCDD	ND	2.4			
1,2,3,6,7,8-HxCDD	ND	2.2			
1,2,3,7,8,9-HxCDD	ND	2.1			
Total HxCDD	ND	2.4			
1,2,3,4,6,7,8-HpCDD	3.9		1.12	8:1	A
Total HpCDD	7.5		1.18	8:1	A
OCDD	34		0.85	>10:1	A,B
2,3,7,8-TCDF	18		0.79	>10:1	
Total TCDF	110		0.83	>10:1	
1,2,3,7,8-PeCDF	4.0		1.51	4:1	A
2,3,4,7,8-PeCDF	9.3		1.32	6:1	A
Total PeCDF	43		1.43	>10:1	A
1,2,3,4,7,8-HxCDF	2.7		1.40	3:1	A
1,2,3,6,7,8-HxCDF	ND	0.93			
2,3,4,6,7,8-HxCDF	ND	1.2			
1,2,3,7,8,9-HxCDF	ND	1.4			
Total HxCDF	7.0		1.32	5:1	A
1,2,3,4,6,7,8-HpCDF	3.3		1.04	7:1	A
1,2,3,4,7,8,9-HpCDF	ND	1.4			
Total HpCDF	3.3		1.04	7:1	A
OCDF	5.1		0.81	4:1	A

Analyst: _____

Reviewer: _____

ALTA

PCDD & PCDF
EPA METHOD 23

Sample ID: M23 Field Blank
Lab ID: 3499-0001-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	96	0.80	
^{13}C-1,2,3,7,8-PeCDD	117	1.60	
^{13}C-1,2,3,6,7,8-HxCDD	102	1.27	
^{13}C-1,2,3,4,6,7,8-HpCDD	112	1.07	
^{13}C-OCDD	94	0.89	
^{13}C-2,3,7,8-TCDF	110	0.79	
^{13}C-1,2,3,7,8-PeCDF	127	1.56	
^{13}C-1,2,3,6,7,8-HxCDF	95	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	104	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	106	NA	
^{13}C-2,3,4,7,8-PeCDF	102	1.58	
^{13}C-1,2,3,4,7,8-HxCDD	111	1.32	
^{13}C-1,2,3,4,7,8-HxCDF	124	0.52	
^{13}C-1,2,3,4,7,8,9-HpCDF	117	0.44	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	86	0.52	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** 4/15/97 **SP-2331:** NA

Analyst: BM

Reviewer:

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23-R1	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0002-SA	**Date Extracted:**	4/11/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	0.67				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	3.3			
Total TCDD	7.5		0.80	8:1	A
1,2,3,7,8-PeCDD	ND	1.3			
Total PeCDD	9.4		1.36	6:1	A
1,2,3,4,7,8-HxCDD	ND	2.0			
1,2,3,6,7,8-HxCDD	ND	1.8			
1,2,3,7,8,9-HxCDD	ND	1.7			
Total HxCDD	14		1.06	>10:1	A
1,2,3,4,6,7,8-HpCDD	8.1		1.02	>10:1	A
Total HpCDD	15		1.14	>10:1	A
OCDD	58		0.89	>10:1	A,B
2,3,7,8-TCDF	ND	2.2			
Total TCDF	29		0.78	9:1	
1,2,3,7,8-PeCDF	ND	1.3			
2,3,4,7,8-PeCDF	ND	1.3			
Total PeCDF	ND	1.6			
1,2,3,4,7,8-HxCDF	2.1		1.27	3:1	A
1,2,3,6,7,8-HxCDF	ND	1.4			
2,3,4,6,7,8-HxCDF	2.3		1.29	3:1	A
1,2,3,7,8,9-HxCDF	ND	1.0			
Total HxCDF	7.8		1.32	5:1	A
1,2,3,4,6,7,8-HpCDF	7.7		1.06	>10:1	A
1,2,3,4,7,8,9-HpCDF	ND	1.0			
Total HpCDF	7.7		1.06	>10:1	A
OCDF	13		0.88	7:1	A

Analyst: _____ Page 1 of 2 Reviewer: _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R1
Lab ID: 3499-0002-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	98	0.81	
^{13}C-1,2,3,7,8-PeCDD	122	1.59	
^{13}C-1,2,3,6,7,8-HxCDD	87	1.31	
^{13}C-1,2,3,4,6,7,8-HpCDD	109	1.07	
^{13}C-OCDD	97	0.89	
^{13}C-2,3,7,8-TCDF	110	0.79	
^{13}C-1,2,3,7,8-PeCDF	113	1.56	
^{13}C-1,2,3,6,7,8-HxCDF	96	0.53	
^{13}C-1,2,3,4,6,7,8-HpCDF	104	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	108	NA	
^{13}C-2,3,4,7,8-PeCDF	70	1.59	
^{13}C-1,2,3,4,7,8-HxCDD	125	1.31	
^{13}C-1,2,3,4,7,8-HxCDF	118	0.52	
^{13}C-1,2,3,4,7,8,9-HpCDF	108	0.44	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	102	0.52	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** 4/15/97 **SP-2331:** NA

Analyst: _____ **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23-R2	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0003-SA	**Date Extracted:**	4/11/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	85				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	2.8			
Total TCDD	22		0.79	>10:1	
1,2,3,7,8-PeCDD	11		1.48	>10:1	A
Total PeCDD	74		1.54	>10:1	
1,2,3,4,7,8-HxCDD	23		1.16	>10:1	A
1,2,3,6,7,8-HxCDD	26		1.34	>10:1	A
1,2,3,7,8,9-HxCDD	31		1.33	>10:1	A
Total HxCDD	290		1.20	>10:1	
1,2,3,4,6,7,8-HpCDD	330		1.02	>10:1	
Total HpCDD	590		1.00	>10:1	
OCDD	2200		0.92	>10:1	B
2,3,7,8-TCDF	6.3		0.66	6:1	A
Total TCDF	130		0.75	>10:1	
1,2,3,7,8-PeCDF	19		1.66	>10:1	A
2,3,4,7,8-PeCDF	31		1.61	>10:1	A
Total PeCDF	300		1.56	>10:1	
1,2,3,4,7,8-HxCDF	87		1.23	>10:1	
1,2,3,6,7,8-HxCDF	79		1.27	>10:1	
2,3,4,6,7,8-HxCDF	180		1.27	>10:1	
1,2,3,7,8,9-HxCDF	34		1.34	>10:1	A
Total HxCDF	880		1.29	>10:1	
1,2,3,4,6,7,8-HpCDF	920		1.05	>10:1	
1,2,3,4,7,8,9-HpCDF	100		1.05	>10:1	
Total HpCDF	1300		1.05	>10:1	
OCDF	770		0.89	>10:1	

Analyst: [signature]

Reviewer: [signature]

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R2
Lab ID: 3499-0003-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	107	0.80	
^{13}C-1,2,3,7,8-PeCDD	129	1.60	
^{13}C-1,2,3,6,7,8-HxCDD	87	1.30	
^{13}C-1,2,3,4,6,7,8-HpCDD	111	1.07	
^{13}C-OCDD	94	0.91	
^{13}C-2,3,7,8-TCDF	110	0.78	
^{13}C-1,2,3,7,8-PeCDF	100	1.56	
^{13}C-1,2,3,6,7,8-HxCDF	96	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	106	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	104	NA	
^{13}C-2,3,4,7,8-PeCDF	103	1.58	
^{13}C-1,2,3,4,7,8-HxCDD	118	1.29	
^{13}C-1,2,3,4,7,8-HxCDF	114	0.53	
^{13}C-1,2,3,4,7,8,9-HpCDF	109	0.43	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	111	0.52	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** NA **SP-2331:** NA

Analyst: BM

Reviewer: JM

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23-R4	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0004-SA	**Date Extracted:**	4/11/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	0.35				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	1.9			
Total TCDD	5.6		0.81	4:1	A
1,2,3,7,8-PeCDD	ND	1.0			
Total PeCDD	8.0		1.62	4:1	A
1,2,3,4,7,8-HxCDD	ND	1.5			
1,2,3,6,7,8-HxCDD	ND	1.9			
1,2,3,7,8,9-HxCDD	ND	1.3			
Total HxCDD	14		1.25	7:1	A
1,2,3,4,6,7,8-HpCDD	8.6		1.05	>10:1	A
Total HpCDD	15		1.10	>10:1	A
OCDD	68		0.91	>10:1	A,B
2,3,7,8-TCDF	ND	2.4			
Total TCDF	13		0.70	5:1	
1,2,3,7,8-PeCDF	ND	1.7			
2,3,4,7,8-PeCDF	ND	1.6			
Total PeCDF	ND	1.7			
1,2,3,4,7,8-HxCDF	ND	0.83			
1,2,3,6,7,8-HxCDF	ND	0.85			
2,3,4,6,7,8-HxCDF	1.3		1.37	3:1	A
1,2,3,7,8,9-HxCDF	ND	1.0			
Total HxCDF	3.3		1.39	3:1	A
1,2,3,4,6,7,8-HpCDF	6.0		1.03	>10:1	A
1,2,3,4,7,8,9-HpCDF	ND	0.68			
Total HpCDF	11		1.03	>10:1	A
OCDF	9.9		0.85	8:1	A

Analyst: _____ **Page 1 of 2** **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R4
Lab ID: 3499-0004-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	101	0.79	
^{13}C-1,2,3,7,8-PeCDD	118	1.58	
^{13}C-1,2,3,6,7,8-HxCDD	89	1.29	
^{13}C-1,2,3,4,6,7,8-HpCDD	106	1.06	
^{13}C-OCDD	91	0.90	
^{13}C-2,3,7,8-TCDF	110	0.78	
^{13}C-1,2,3,7,8-PeCDF	92	1.55	
^{13}C-1,2,3,6,7,8-HxCDF	92	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	101	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	105	NA	
^{13}C-2,3,4,7,8-PeCDF	105	1.58	
^{13}C-1,2,3,4,7,8-HxCDD	125	1.29	
^{13}C-1,2,3,4,7,8-HxCDF	115	0.52	
^{13}C-1,2,3,4,7,8,9-HpCDF	112	0.43	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	106	0.52	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** NA **SP-2331:** NA

Analyst: _____ **Page 2 of 2** **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R5 **Date Received:** 4/1/97 **ICAL ID:** I428
Lab ID: 3499-0005-SA **Date Extracted:** 4/11/97 **QC Lot:** LC0411M
Matrix: M23 **Sample Amount:** Sample **Units:** pg/sample
TEQ: 50

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	14		0.74	6:1	
Total TCDD	3000		0.80	>10:1	
1,2,3,7,8-PeCDD	20		1.60	>10:1	A
Total PeCDD	610		1.58	>10:1	
1,2,3,4,7,8-HxCDD	16		1.18	>10:1	A
1,2,3,6,7,8-HxCDD	18		1.33	>10:1	A
1,2,3,7,8,9-HxCDD	12		1.27	>10:1	A
Total HxCDD	530		1.24	>10:1	
1,2,3,4,6,7,8-HpCDD	65		1.05	>10:1	
Total HpCDD	140		1.04	>10:1	
OCDD	140		0.91	>10:1	B
2,3,7,8-TCDF	83		0.82	>10:1	
Total TCDF	8100		0.74	>10:1	d
1,2,3,7,8-PeCDF	14		1.42	>10:1	A
2,3,4,7,8-PeCDF	18		1.56	>10:1	A
Total PeCDF	230		1.56	>10:1	
1,2,3,4,7,8-HxCDF	9.9		1.33	>10:1	A
1,2,3,6,7,8-HxCDF	6.5		1.35	>10:1	A
2,3,4,6,7,8-HxCDF	8.7		1.33	>10:1	A
1,2,3,7,8,9-HxCDF	2.7		1.30	7:1	A
Total HxCDF	66		1.15	>10:1	
1,2,3,4,6,7,8-HpCDF	22		1.10	>10:1	A
1,2,3,4,7,8,9-HpCDF	6.5		1.04	>10:1	A
Total HpCDF	35		1.10	>10:1	A
OCDF	24		0.85	>10:1	A

Analyst: _____

Reviewer: _____

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R5
Lab ID: 3499-0005-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	99	0.80	
^{13}C-1,2,3,7,8-PeCDD	129	1.59	
^{13}C-1,2,3,6,7,8-HxCDD	102	1.28	
^{13}C-1,2,3,4,6,7,8-HpCDD	118	1.07	
^{13}C-OCDD	98	0.89	
^{13}C-2,3,7,8-TCDF	110	0.79	
^{13}C-1,2,3,7,8-PeCDF	126	1.57	
^{13}C-1,2,3,6,7,8-HxCDF	102	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	104	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	105	NA	
^{13}C-2,3,4,7,8-PeCDF	100	1.59	
^{13}C-1,2,3,4,7,8-HxCDD	120	1.29	
^{13}C-1,2,3,4,7,8-HxCDF	116	0.53	
^{13}C-1,2,3,4,7,8,9-HpCDF	118	0.43	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	61	0.52	

Dates Analyzed:

DB-5: 4/15/97 DB-225: 4/15/97 SP-2331: NA

Analyst: _____ Page 2 of 2 Reviewer: _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23-R6 **Date Received:** 4/1/97 **ICAL ID:** I428
Lab ID: 3499-0006-SA **Date Extracted:** 4/11/97 **QC Lot:** LC0411M
Matrix: M23 **Sample Amount:** Sample **Units:** pg/sample
TEQ: 88

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	22		0.65	>10:1	
Total TCDD	5100		0.78	>10:1	
1,2,3,7,8-PeCDD	36		1.50	>10:1	A
Total PeCDD	1700		1.62	>10:1	
1,2,3,4,7,8-HxCDD	24		1.25	>10:1	A
1,2,3,6,7,8-HxCDD	22		1.23	>10:1	A
1,2,3,7,8,9-HxCDD	15		1.32	>10:1	A
Total HxCDD	790		1.27	>10:1	
1,2,3,4,6,7,8-HpCDD	71		1.05	>10:1	
Total HpCDD	150		1.03	>10:1	
OCDD	120		0.90	>10:1	B
2,3,7,8-TCDF	200		0.78	>10:1	
Total TCDF	20000		0.78	>10:1	D
1,2,3,7,8-PeCDF	25		1.53	>10:1	A
2,3,4,7,8-PeCDF	33		1.58	>10:1	A
Total PeCDF	970		1.35	>10:1	D
1,2,3,4,7,8-HxCDF	10		1.27	>10:1	A
1,2,3,6,7,8-HxCDF	7.7		1.31	>10:1	A
2,3,4,6,7,8-HxCDF	9.4		1.28	>10:1	A
1,2,3,7,8,9-HxCDF	2.6		1.33	4:1	A
Total HxCDF	91		1.30	>10:1	
1,2,3,4,6,7,8-HpCDF	21		1.09	>10:1	A
1,2,3,4,7,8,9-HpCDF	3.2		1.18	3:1	A
Total HpCDF	33		1.09	>10:1	A
OCDF	14		0.93	8:1	A

Analyst: _____ Reviewer: _____

ALTA

PCDD & PCDF
EPA METHOD 23

Sample ID: M23-R6
Lab ID: 3499-0006-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	102	0.80	
^{13}C-1,2,3,7,8-PeCDD	122	1.60	
^{13}C-1,2,3,6,7,8-HxCDD	84	1.30	
^{13}C-1,2,3,4,6,7,8-HpCDD	104	1.06	
^{13}C-OCDD	93	0.90	
^{13}C-2,3,7,8-TCDF	111	0.79	
^{13}C-1,2,3,7,8-PeCDF	99	1.57	
^{13}C-1,2,3,6,7,8-HxCDF	93	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	101	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	100	NA	
^{13}C-2,3,4,7,8-PeCDF	99	1.57	
^{13}C-1,2,3,4,7,8-HxCDD	129	1.29	
^{13}C-1,2,3,4,7,8-HxCDF	111	0.53	
^{13}C-1,2,3,4,7,8,9-HpCDF	106	0.45	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	106	0.53	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** 4/15/97 **SP-2331:** NA

Analyst: _____ **Page 2 of 2** **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23-R7	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0007-SA	**Date Extracted:**	4/11/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	96				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	26		0.65	>10:1	
Total TCDD	5700		0.78	>10:1	
1,2,3,7,8-PeCDD	45		1.38	>10:1	A
Total PeCDD	2100		1.61	>10:1	
1,2,3,4,7,8-HxCDD	33		1.29	>10:1	A
1,2,3,6,7,8-HxCDD	30		1.20	>10:1	A
1,2,3,7,8,9-HxCDD	24		1.30	>10:1	A
Total HxCDD	960		1.25	>10:1	
1,2,3,4,6,7,8-HpCDD	130		1.04	>10:1	
Total HpCDD	270		1.05	>10:1	
OCDD	520		0.91	>10:1	B
2,3,7,8-TCDF	190		0.84	>10:1	
Total TCDF	18000		0.78	>10:1	D
1,2,3,7,8-PeCDF	32		1.41	>10:1	A
2,3,4,7,8-PeCDF	42		1.68	>10:1	A
Total PeCDF	1000		1.52	>10:1	D
1,2,3,4,7,8-HxCDF	31		1.27	>10:1	A
1,2,3,6,7,8-HxCDF	27		1.25	>10:1	A
2,3,4,6,7,8-HxCDF	48		1.29	>10:1	A
1,2,3,7,8,9-HxCDF	11		1.23	>10:1	A
Total HxCDF	290		1.23	>10:1	
1,2,3,4,6,7,8-HpCDF	210		1.03	>10:1	
1,2,3,4,7,8,9-HpCDF	28		1.07	>10:1	A
Total HpCDF	320		1.03	>10:1	
OCDF	190		0.91	>10:1	

Analyst: _____

Reviewer: _____

ALTA

PCDD & PCDF
EPA METHOD 23

Sample ID: M23-R7
Lab ID: 3499-0007-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	104	0.79	
^{13}C-1,2,3,7,8-PeCDD	126	1.59	
^{13}C-1,2,3,6,7,8-HxCDD	86	1.28	
^{13}C-1,2,3,4,6,7,8-HpCDD	103	1.06	
^{13}C-OCDD	93	0.91	
^{13}C-2,3,7,8-TCDF	114	0.79	
^{13}C-1,2,3,7,8-PeCDF	102	1.58	
^{13}C-1,2,3,6,7,8-HxCDF	97	0.53	
^{13}C-1,2,3,4,6,7,8-HpCDF	103	0.45	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	102	NA	
^{13}C-2,3,4,7,8-PeCDF	102	1.59	
^{13}C-1,2,3,4,7,8-HxCDD	119	1.27	
^{13}C-1,2,3,4,7,8-HxCDF	111	0.52	
^{13}C-1,2,3,4,7,8,9-HpCDF	106	0.45	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	108	0.53	

Dates Analyzed:

DB-5: 4/14/97 **DB-225:** 4/15/97 **SP-2331:** NA

Analyst: _____ **Page 2 of 2** **Reviewer:** _____

ALTA

APPENDIX

ALTA

DATA QUALIFIERS & ABBREVIATIONS

A	The amount detected is below the Method Calibration Limit.
B	This compound was also detected in the blank.
C	The amount detected is less than five times the Method Quantitation Limit.
D	The amount reported is the maximum possible concentration.
E	The detection limit was raised above the Method Quantitation Limit due to chemical interferences.
F	This result has been confirmed on a DB-225 column.
G	This result has been confirmed on a SP-2331 column.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference

Conc.	Concentration
D.L.	Detection Limit
NA	Not applicable
S/N	Signal-to-noise
*	See Cover Letter
ND	Not Detected
MPC	Maximum Possible Concentration

Bureau of Reclamation - Mid-Pacific Region — (MP-470, Res-1.10)

Commonwealth of Kentucky — (Certificate No. 90063)

Commonwealth of Virginia

State of Alaska — (Certificate No. OS-00197)

State of Arizona Department of Health Services — (Certificate No. AZ0058)

State of Arkansas Department of Health — (Approval granted through CA certification)

State of Arkansas Department of Pollution Control

State of California — (Certificate No. 1640)

State of Connecticut — (Certificate No. PH-0182)

State of Florida — (Certificate No. 87456)

State of Nevada — (Certificate No. CA413)

State of New York Department of Health — (Certificate No. 11411)

State of North Carolina — (Certification No. 06700)

State of North Dakota Department of Health — (Certificate No. R-078)

State of Oregon

State of Pennsylvania — (Certificate No. 68-490)

State of South Carolina — (Certificate No. 87002001)

State of Tennessee — (Certificate No. 02996)

State of Utah — (Certificate No. E-201)

State of Wisconsin — (Certificate No. 998036160)

State of Wyoming — (Ref: 8ES-LB)

U.S. Army Corps of Engineers

U.S. EPA Region 5

Washington Department of Ecology — (Certification No. C091)

1-17-97

AMTEST Professional Analytical Services | Redmond, WA 98052 | Tel: 206 885 1664

Alta Labs

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
97-012	Ash Grove Seattle

SAMPLERS: *(Signature)*

Client Name: AmTest Air Quality
Client Address: 30545 S.E. 84th St. #5
Client Phone: Preston, WA 98050
Contact Person: Jeanne
P.O. No.: 97-012

LAB # ~~STA. NO.~~	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	M23 XAD trap	M23 Filter	M23 ACE/Dcm rinses	M23 Toluene rinses	M23 Impinger catch
1451	3/25	7:00	✓		R-1 Main Stack	4	✓	✓	✓	✓	✓
1452	3/25	11:17	✓		R-2	4	✓	✓	✓	✓	✓
1453	3/26	13:03	✓		R-4	4	✓	✓	✓	✓	✓
1454	3/27	7:00	✓		R-5	4	✓	✓	✓	✓	✓
1455	3/27	10:45	✓		R-6	4	✓	✓	✓	✓	✓
1456	3/29	14:55	✓		R-7	4	✓	✓	✓	✓	✓
FB	3/24		✓		Field Blank	4	✓	✓	✓	✓	✓
TB			✓		Trip Blank	1	✓				

Analysis: PCDD/PCDF according to SW-846 Method 8290X
All extracts from each run (ACE/Dcm and Toluene rinses) will be combined and volume reduced to 1 ml resulting in 1 extract per run — aliquot will taken for analysis

* There is not a run 3

(There will be 4 separate containers shipped)

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Jeanne Thompson	3/31/97				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)* Ken Acta Fong	Date/Time: 4-1-97	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

AGCS2M003251

990009

ALTA Analytical Laboratory

Project No.: 3499

Sample Log-In Checklist	Yes	No
1. Date Samples Arrived: 4-1-97 Initials: [illegible]		
2. Samples Arrived By: (circle one) Airborne Express (Federal Express) (UPS) (Emery) Freezer Truck Company Courier Other See Below		
3. Shipping Documentation Present? (circle one) Shipping Label (Airbill) Tracking Number See Below	X	
4. Shipping Container(s) Intact? If no, describe condition below.	X	
5. Custody Seals Present and Intact? If not intact, describe condition below. No. of Seals _____ or Seal No. _____ Type:(circle) Bottle or Container		X
6. Sample Container Intact? If no, indicate sample condition below.	X	
7. Shipping Preservation: (circle) Ice / (Blue Ice) / Dry Ice / Ambient / None Temp(°C) See Below		
8. Chain of Custody (COC) or other Sample Documentation Present?	X	
9. COC/Documentation Acceptable? If no, complete COC Anomaly Form.	X	
10. Shipping Container: (circle) (ALTA) or Client / (Return) or (Retain)		
11. Container and/or Bottles Requested?		X
12. Sample Control Check In/Out Log Completed?	X	
*13. Drinking Water Sample? If yes, Acceptable Preservation? (circle) Y or N		X

*Required for HRMS

Name: _____ Date Samples Reconciled: _____

(Signature Required for LCMS Only)

Comments: UPS 1Z05388X1310000023 16°C
UPS 1Z05388X1310000014 16°C
FedEX 120716 7091 14°C
Emery 1614428266 18°C

ALTA

April 29, 1997

Alta Batch I.D.: 3499

Ms. Judy Aasland
Amtest, Inc.
30545 Southeast 84th Street, Suite 5
Preston, WA 98050

Dear Ms. Aasland,

Enclosed are the results for the M23 trip blank received at Alta Analytical Laboratory on April 1, 1997. This work was authorized under your Project # 97-012. As per your request on 4/24/97 the Trip Blank was to be extracted and analyzed using EPA Method 23 for tetra to octa chlorinated dioxins/dibenzofurans using High Resolution Mass Spectrometry (HRMS). A standard turnaround time was requested for this work.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations, our current certifications, and copies of the raw data (if requested).

If you have any questions regarding this report please feel free to contact me.

Sincerely,

Robert S. Mitzel
Director of Air Toxics

Alta Analytical Laboratory Inc.
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762
FAX (916) 933-0940
(916) 933-1640

ALTA

Sample Inventory Report

Project No.: 3499 **Project Name:** General Analytical AIR
Date Rec.: 4/ 1/97

Lab. Sample ID	Client Sample ID	SGI Component Type
0001	M23-Field Blank	ACE/DCM
0001	M23-Field Blank	Filter
0001	M23-Field Blank	Impinger Catch
0001	M23-Field Blank	Toluene
0001	M23-Field Blank	Xad
0002	M23-R1	ACE/DCM
0002	M23-R1	Filter
0002	M23-R1	Impinger Catch
0002	M23-R1	Toluene
0002	M23-R1	Xad
0003	M23-R2	ACE/DCM
0003	M23-R2	Filter
0003	M23-R2	Impinger Catch
0003	M23-R2	Toluene
0003	M23-R2	Xad
0004	M23-R4	ACE/DCM
0004	M23-R4	Filter
0004	M23-R4	Impinger Catch
0004	M23-R4	Toluene
0004	M23-R4	Xad
0005	M23-R5	ACE/DCM
0005	M23-R5	Filter
0005	M23-R5	Impinger Catch
0005	M23-R5	Toluene
0005	M23-R5	Xad
0006	M23-R6	ACE/DCM
0006	M23-R6	Filter
0006	M23-R6	Impinger Catch
0006	M23-R6	Toluene
0006	M23-R6	Xad
0007	M23-R7	ACE/DCM
0007	M23-R7	Filter
0007	M23-R7	Impinger Catch
0007	M23-R7	Toluene
0007	M23-R7	Xad
0008	M23-Trip Blank	Xad

ALTA

SECTION II.

ALTA

PCDD & PCDF

EPA METHOD 23

Method Blank
Lab ID: 3499-8MB
Matrix: M23
TEQ: 0.0053

Date Received: NA
Date Extracted: 4/25/97
Sample Amount: Sample

ICAL ID: I428
QC Lot: LC0411M
Units: pg/sample

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	2.0			
Total TCDD	ND	2.0			
1,2,3,7,8-PeCDD	ND	0.90			
Total PeCDD	ND	0.90			
1,2,3,4,7,8-HxCDD	ND	1.1			
1,2,3,6,7,8-HxCDD	ND	1.0			
1,2,3,7,8,9-HxCDD	ND	0.96			
Total HxCDD	ND	1.1			
1,2,3,4,6,7,8-HpCDD	ND	0.59			
Total HpCDD	ND	0.59			
OCDD	5.3		0.83	8:1	A
2,3,7,8-TCDF	ND	1.2			
Total TCDF	ND	1.2			
1,2,3,7,8-PeCDF	ND	1.1			
2,3,4,7,8-PeCDF	ND	1.1			
Total PeCDF	ND	1.1			
1,2,3,4,7,8-HxCDF	ND	0.34			
1,2,3,6,7,8-HxCDF	ND	0.27			
2,3,4,6,7,8-HxCDF	ND	0.33			
1,2,3,7,8,9-HxCDF	ND	0.39			
Total HxCDF	ND	0.39			
1,2,3,4,6,7,8-HpCDF	ND	0.55			
1,2,3,4,7,8,9-HpCDF	ND	0.68			
Total HpCDF	ND	0.68			
OCDF	ND	1.4			

Analyst: _____

Reviewer: _____

ALTA

PCDD & PCDF
EPA METHOD 23

Method Blank
Lab ID: 3499-8MB

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	98	0.78	
^{13}C-1,2,3,7,8-PeCDD	98	1.58	
^{13}C-1,2,3,6,7,8-HxCDD	92	1.28	
^{13}C-1,2,3,4,6,7,8-HpCDD	96	1.04	
^{13}C-OCDD	84	0.92	
^{13}C-2,3,7,8-TCDF	109	0.79	
^{13}C-1,2,3,7,8-PeCDF	106	1.58	
^{13}C-1,2,3,6,7,8-HxCDF	78	0.51	
^{13}C-1,2,3,4,6,7,8-HpCDF	88	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	NA	NA	
^{13}C-2,3,4,7,8-PeCDF	NA	NA	
^{13}C-1,2,3,4,7,8-HxCDD	NA	NA	
^{13}C-1,2,3,4,7,8-HxCDF	NA	NA	
^{13}C-1,2,3,4,7,8,9-HpCDF	NA	NA	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	104	0.51	

Dates Analyzed:

DB-5: 4/28/97 **DB-225:** NA **SP-2331:** NA

Analyst: _____ **Reviewer:** _____

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID:	M23 Trip Blank	**Date Received:**	4/1/97	**ICAL ID:**	I428
Lab ID:	3499-0008-SA	**Date Extracted:**	4/25/97	**QC Lot:**	LC0411M
Matrix:	M23	**Sample Amount:**	Sample	**Units:**	pg/sample
TEQ:	0.0082				

Compound	Conc.	D.L.	Ratio	S/N Ratio	Qualifier
2,3,7,8-TCDD	ND	2.2			
Total TCDD	ND	2.2			
1,2,3,7,8-PeCDD	ND	0.88			
Total PeCDD	ND	0.88			
1,2,3,4,7,8-HxCDD	ND	1.2			
1,2,3,6,7,8-HxCDD	ND	1.1			
1,2,3,7,8,9-HxCDD	ND	1.0			
Total HxCDD	ND	1.2			
1,2,3,4,6,7,8-HpCDD	ND	0.86			
Total HpCDD	ND	0.86			
OCDD	8.2		0.84	>10:1	A,B
2,3,7,8-TCDF	ND	1.2			
Total TCDF	ND	1.2			
1,2,3,7,8-PeCDF	ND	1.2			
2,3,4,7,8-PeCDF	ND	1.1			
Total PeCDF	ND	1.2			
1,2,3,4,7,8-HxCDF	ND	0.50			
1,2,3,6,7,8-HxCDF	ND	0.39			
2,3,4,6,7,8-HxCDF	ND	0.49			
1,2,3,7,8,9-HxCDF	ND	0.57			
Total HxCDF	ND	0.57			
1,2,3,4,6,7,8-HpCDF	ND	0.66			
1,2,3,4,7,8,9-HpCDF	ND	0.86			
Total HpCDF	ND	0.86			
OCDF	ND	1.7			

Analyst: BM

Reviewer:

ALTA

PCDD & PCDF

EPA METHOD 23

Sample ID: M23 Trip Blank
Lab ID: 3499-0008-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	95	0.79	
^{13}C-1,2,3,7,8-PeCDD	96	1.47	
^{13}C-1,2,3,6,7,8-HxCDD	94	1.28	
^{13}C-1,2,3,4,6,7,8-HpCDD	98	1.04	
^{13}C-OCDD	88	0.90	
^{13}C-2,3,7,8-TCDF	103	0.78	
^{13}C-1,2,3,7,8-PeCDF	100	1.57	
^{13}C-1,2,3,6,7,8-HxCDF	82	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	90	0.44	
Pre-spike Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	103	NA	
^{13}C-2,3,4,7,8-PeCDF	101	1.58	
^{13}C-1,2,3,4,7,8-HxCDD	114	1.27	
^{13}C-1,2,3,4,7,8-HxCDF	115	0.51	
^{13}C-1,2,3,4,7,8,9-HpCDF	108	0.43	
Alternate Recovery Standard:			
^{13}C-1,2,3,7,8,9-HxCDF	103	0.51	

Dates Analyzed:

DB-5: 4/28/97 **DB-225:** NA **SP-2331:** NA

Analyst: _____ **Page 2 of 2** **Reviewer:** _____

APPENDIX

ALTA

DATA QUALIFIERS & ABBREVIATIONS

A	The amount detected is below the Method Calibration Limit.
B	This compound was also detected in the blank.
C	The amount detected is less than five times the Method Quantitation Limit.
D	The amount reported is the maximum possible concentration.
E	The detection limit was raised above the Method Quantitation Limit due to chemical interferences.
F	This result has been confirmed on a DB-225 column.
G	This result has been confirmed on a SP-2331 column.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference

Conc.	Concentration
D.L.	Detection Limit
NA	Not applicable
S/N	Signal-to-noise
*	See Cover Letter
ND	Not Detected
MPC	Maximum Possible Concentration

CURRENT CERTIFICATIONS

ALTA

Bureau of Reclamation - Mid-Pacific Region — (MP-470, Res-1.10)

Commonwealth of Kentucky — (Certificate No. 90063)

Commonwealth of Virginia

State of Alaska — (Certificate No. OS-00197)

State of Arizona Department of Health Services — (Certificate No. AZ0058)

State of Arkansas Department of Health — (Approval granted through CA certification)

State of Arkansas Department of Pollution Control

State of California — (Certificate No. 1640)

State of Connecticut — (Certificate No. PH-0182)

State of Florida — (Certificate No. 87456)

State of Nevada — (Certificate No. CA413)

State of New York Department of Health — (Certificate No. 11411)

State of North Carolina — (Certification No. 06700)

State of North Dakota Department of Health — (Certificate No. R-078)

State of Oregon

State of Pennsylvania — (Certificate No. 68-490)

State of South Carolina — (Certificate No. 87002001)

State of Tennessee — (Certificate No. 02996)

State of Utah — (Certificate No. E-201)

State of Wisconsin — (Certificate No. 998036160)

State of Wyoming — (Ref: 8ES-LB)

U.S. Army Corps of Engineers

U.S. EPA Region 5

Washington Department of Ecology — (Certification No. C091)

1-17-97

Analytical Services
98052 Tel: 206 885 1664

Alta Labs

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
97-012	Ash Grove Seattle

SAMPLERS: *(Signature)*

Client Name: AmTest Air Quality
Client Address: 30545 S.E. 84th St. #5
Client Phone: Preston, WA 98050
Contact Person: Jeanne
P.O. No.: 97-012

LAB # ~~STA. NO.~~	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	M23 XAD trap	Filter	ACE/DCM rinses	Toluene rinses	Impinger catch
1451	3/25	7:00	✓		R-1 Main Stack	4	✓	✓	✓	✓	✓
1452	3/25	11:17	✓		R-2	4	✓	✓	✓	✓	✓
1453	3/26	13:03	✓		R-4	4	✓	✓	✓	✓	✓
1454	3/27	7:00	✓		R-5	4	✓	✓	✓	✓	✓
1455	3/27	10:45	✓		R-6	4	✓	✓	✓	✓	✓
1456	3/29	11:55	✓		R-7	4	✓	✓	✓	✓	✓
FB	3/24		✓		Field Blank	4	✓	✓	✓	✓	✓
TB			✓		Trip Blank	1	✓				

Analysis: PCDD/PCDF according to SW-846 Method 8290X
All extracts from each run (ACE/DCM and Toluene rinses) will be combined and volume reduced to 1 ml resulting in 1 extract per run — aliquot will taken for analysis

* There is not a run 3

(There will be 4 separate containers shipped)

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Jeanne Thompson	3/31/97				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)* Ken Acta Fultz	Date/Time 4-1-97	Remarks	

S80078

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

AGCS2M003263

ALTA Analytical Laboratory

Project No.: 3499

Sample Log-In Checklist	Yes	No
1. Date Samples Arrived: 4-1-97 Initials: MR		
2. Samples Arrived By: (circle one) Airborne Express (Federal Express) (UPS) (Emery) Freezer Truck Company Courier Other See Below		
3. Shipping Documentation Present? (circle one) Shipping Label (Airbill) Tracking Number See Below	X	
4. Shipping Container(s) Intact? If no, describe condition below.	X	
5. Custody Seals Present and Intact? If not intact, describe condition below. No. of Seals _____ or Seal No. _____ Type:(circle) Bottle or Container		X
6. Sample Container Intact? If no, indicate sample condition below.	X	
7. Shipping Preservation: (circle) Ice / (Blue Ice) / Dry Ice / Ambient / None Temp(°C) See Below		
8. Chain of Custody (COC) or other Sample Documentation Present?	X	
9. COC/Documentation Acceptable? If no, complete COC Anomaly Form.	X	
10. Shipping Container: (circle) (ALTA) or (Client) / (Return) or (Retain)		
11. Container and/or Bottles Requested?		X
12. Sample Control Check In/Out Log Completed?	X	
*13. Drinking Water Sample? If yes, Acceptable Preservation? (circle) Y or N		X

*Required for HRMS

Name: _____ Date Samples Reconciled: _____

(Signature Required for LCMS Only)

Comments:
UPS 1Z05388X1310000023 16°C
UPS 1Z05388X1310000014 16°C
FedEX 120716 7091 14°C
Emery 1614428266 18°C

AMTEST

ANALYSIS REPORT

Am Test Air Quality, L.L.C.
30545 SE 84th Street
Suite 5
Preston, WA 98050
Attention: Jeanne

Date Received: 4/ 1/97
Date Reported: 4/29/97

Project Name: Ash Grove Seattle
PO Number: 97-
Date Sampled: 4/ 1/97

PARAMETER	UNITS	DILUTION	RESULT	M.D.L.
97-A004268				
Client ID: 1457 R-1 Main Stack				
Volume	(mls)		640	
METALS				
Mercury	(ug)	5	40.	0.32
97-A004269				
Client ID: 1458 R-2 Main Stack				
Volume	(mls)		590	
METALS				
Mercury	(ug)	5	41.	0.295
97-A004270				
Client ID: 1459 R-4 Main Stack				
Volume	(mls)		640	
METALS				
Mercury	(ug)	5	38.	0.32
97-A004271				
Client ID: 1460 R-5 Main Stack				
Volume	(mls)		600	
METALS				
Mercury	(ug)	50	1500	3.0
97-A004272				
Client ID: 1461 R-6 Main Stack				
Volume	(mls)		620	
METALS				
Mercury	(ug)	50	1500	3.1

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AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1564

AMTEST

ANALYSIS REPORT

Am Test Air Quality, L.L.C.

Attention: Jeanne

Date Received: 4/ 1/97
Date Reported: 4/29/97

PARAMETER	UNITS	DILUTION	RESULT	MDL
97-A004273				
Client ID: 1462 R-7 Main Stack				
Volume	(mls)		630	
METALS				
Mercury	(ug)	50	1500	3.15
97-A004274				
Client ID: Field Blank				
Volume	(mls)		480	
METALS				
Mercury	(ug)	5	0.91	0.24
97-A004275				
Client ID: Reagent Blank				
Volume	(mls)		300	
METALS				
Mercury	(ug)	5	< 0.15	0.15

M.D.L. - Method Detection Limit

EPA Method 245.1
0.0001 ug/ml DL

Reported by: Kathy Fugiel

AMTEST

Client: Am Test Air Quality, L.L.C.
30545 SE 84th Street
Suite 5
Preston , WA 98050
Atten: Jeanne

Date Received: 4/01/97
Date Reported 4/29/97

Associated
Sample numbers:
97-A004268 to 4275

QUALITY CONTROL SUMMARY EPA Method 245.1

BLANKS		RESULT
Mercury	ug/ml	<0.0001
	ug/ml	<0.0001

STANDARD REFERENCE MATERIAL

		Measured Value	True Value	Recovery %
Mercury	ug/ml	0.0084	0.01	84.0
		0.0056	0.005	112.0
		0.0054	0.005	108.0

DUPLICATE

		Sample Value	Duplicate Value	RPD %
Mercury	ug/ml			
4268		0.0617	0.0623	-1.0
4272		2.38	2.5	-4.9

SPIKE RECOVERY

		Sample conc	Sam + Spk conc	Spike added	Recovery %
Mercury	ug/ml				
4269		0.0688	0.0795	0.01	107

Reported By: Kathy Fugiel

AMTEST
ANALYSIS REQUEST

Date Submitted: 4/1/97

Client: Ash Grove Seattle

P.O. Number: 97-

Address: ATAQ

Date Sampled: 3/25-27/97

Number of Bottles: 8

Number of Samples: 8

Contact: Jeanne Phone: 222-7746 Fax: 222-7849

Matrix: drinking water ____ water ____ soil ____ sludge ____ oil ____

other KMnO4, HCl, H2SO4

ATAQ Lab No.	Am Test Sample No.	Client Identification	Analysis Requested	Volume (mls)
		M101A		
1457	4268	R-1 Main Stack KMnO4/HCl	Hg by CVAA	640
1458	4269	R-2		642
1459	4270	R-4		640
1460	4271	R-5		600
1461	4272	R-6		630
1462	4273	R-7		630
Field Blank	4274	Field Blank KMnO4/HCl		480
Reagent Blank	4275	KMnO4/HCl Blank		300
			*We need duplicates for 10% of samples	

Comments: **Please fax a copy of this document to Am Test-Air Quality, LLC after the laboratory numbers have been assigned. Thank you.**

Please Do Not Write Below This Line - Laboratory Use Only

cc: Micro ____ T.O. ____ WChem ____ Ind ____

Date Sample Rec'd: ____ Rec'd By: ____ Logged in: ____

Final Report To: ____ Shelf No.: ____ T.O. Shelf No.: AGCS2M003268 S300683

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AMTEST

AmTest Inc.
Professional
Analytical
Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

ANALYSIS REPORT

Ash Grove Cement Company
Western Region
3801 East Marginal Way South
Seattle, WA 98134
Attention: Patrick Noon

Date Received: 4/ 9/97
Date Reported: 4/28/97

Project Name: Ash Grove Seattle

SOIL SAMPLES

PARAMETER	Units	Result
97-A004731		
Client ID: 0411-97A Kilnfeed		
Total Solids	%	100
Mercury	ug/g	0.68
97-A004732		
Client ID: 0411-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	6.2
97-A004733		
Client ID: 0411-97C Clinker		
Total Solids	%	100
Mercury	ug/g	< 0.02
97-A004734		
Client ID: 0411-97D Coal		
Total Solids	%	98.
Mercury	ug/g	0.065
97-A004735		
Client ID: 0411-97E Tire		
Total Solids	%	100
Mercury	ug/g	0.032
97-A004736		
Client ID: 0411-97G Rawmix		
Total Solids	%	100
Mercury	ug/g	0.039
97-A004737		
Client ID: 0412-97A Kilnfeed		
Total Solids	%	100
Mercury	ug/g	0.89
97-A004738		
Client ID: 0412-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	6.0

AMTEST

ANALYSIS REPORT

Ash Grove Cement Company

Date Received: 4/ 9/97
Date Reported: 4/28/97

Attention: Patrick Noon

SOIL SAMPLES

PARAMETER	Units	Result
97-A004739		
Client ID: 0412-97C Clinker		
Total Solids	%	100
Mercury	ug/g	< 0.02
97-A004740		
Client ID: 0412-97D Coal		
Total Solids	%	98.
Mercury	ug/g	0.070
97-A004741		
Client ID: 0412-97G Rawmix		
Total Solids	%	100
Mercury	ug/g	0.020
97-A004742		
Client ID: 0413-97A Kilnfeed		
Total Solids	%	100
Mercury	ug/g	0.83
97-A004743		
Client ID: 0413-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	3.9
97-A004744		
Client ID: 0413-97C Clinker		
Total Solids	%	100
Mercury	ug/g	< 0.02
97-A004745		
Client ID: 0413-97D Coal		
Total Solids	%	98.
Mercury	ug/g	0.054
97-A004746		
Client ID: 0413-97G Rawmix		
Total Solids	%	100
Mercury	ug/g	0.020

AMTEST

ANALYSIS REPORT

Ash Grove Cement Company

Date Received: 4/ 9/97
Date Reported: 4/28/97

Attention: Patrick Noon

SOIL SAMPLES

PARAMETER	Units	Result
97-A004747		
Client ID: 0431-97A Kilnfeed		
Total Solids	%	100
Mercury	ug/g	0.82
97-A004748		
Client ID: 0431-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	1.5
97-A004749		
Client ID: 0431-97C Clinker		
Total Solids	%	100
Mercury	ug/g	< 0.02
97-A004750		
Client ID: 0431-97D Coal		
Total Solids	%	98.
Mercury	ug/g	0.047
97-A004751		
Client ID: 0432-97A Kilnfeed		
Total Solids	%	79.
Mercury	ug/g	0.72
97-A004752		
Client ID: 0432-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	1.5
97-A004753		
Client ID: 0432-97C Clinker		
Total Solids	%	100
Mercury	ug/g	< 0.02
97-A004754		
Client ID: 0432-97D Coal		
Total Solids	%	98.
Mercury	ug/g	0.030

AMTEST

ANALYSIS REPORT

Ash Grove Cement Company

Date Received: 4/ 9/97
Date Reported: 4/28/97

Attention: Patrick Noon

SOIL SAMPLES

PARAMETER	Units	Result
97-A004755		
Client ID: 0433-97A Kilnfeed		
Total Solids	%	81.
Mercury	ug/g	0.85
97-A004756		
Client ID: 0433-97B Return Dust		
Total Solids	%	100
Mercury	ug/g	1.4
97-A004757		
Client ID: 0433-97C Clinker		
Total Solids	%	81.
Mercury	ug/g	< 0.02
97-A004758		
Client ID: 0433-97D Coal		
Total Solids	%	100
Mercury	ug/g	< 0.02

Reported by: Kathy Fugiel

AMTEST

METHODOLOGY REPORT

AM TEST ID 97-A004731 MATRIX : Soil
CLIENT ID 0411-97A Kilnfeed SAMPLED: 3/25/97

ANALYTE	UNITS	METHOD NUMBER	METHOD REFERENCE	DETECTION LIMIT *	DATE OF ANALYSIS
Total Solids	%	2540B	SM	0.10	4/13/97
Mercury (solids)	ug/g	7470	SW-846	0.020	4/17/97
Mercury (liquids)	ug/ml	245.1	EPA	0.0001	4/17/97

;M = Standard Methods for the Examination of Water and Wastewater 18th ed.
;W-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods
:PA = Methods for Chemical Analysis of Water and Wastes 1983
Instrument Detection Limit

AMTEST

Quality Control Summary

QC for 97-A004731 - 97-A004758

DUPLICATES		sample value	duplicate value	RPD %
97-A004656 DUP: Total Solids	%	100	100	0.00
97-A004666 DUP: Total Solids	%	100	100	0.00
97-A004676 DUP: Total Solids	%	100	100	0.00
97-A004740 DUP: Total Solids	%	98.	98.	0.00
97-A004744 DUP: Total Solids	%	100	100	0.00
97-A004754 DUP: Total Solids	%	98.	98.	0.00
97-A004731 DUP: Mercury	ug/g	0.685	0.752	9.3
97-A004741 DUP: Mercury	ug/g	0.020	0.024	18.
97-A004751 DUP: Mercury	ug/g	1.44	1.40	2.8
97-A004745 DUP: Mercury	ug/g	0.054	0.053	1.9

MATRIX SPIKES		sample value	sample+spk value	spike value	Recovery %
97-A004732 SPIKE: Mercury	ug/g	0.205	2.52	2.86	80.9
97-A004742 SPIKE: Mercury	ug/g	0.830	0.960	0.180	72.2
97-A004752 SPIKE: Mercury	ug/g	0.180	5.53	5.00	107.
97-A004757 SPIKE: Mercury	ug/g	< 0.02	1.02	1.00	102.

STANDARD REFERENCE MATERIALS		measured value	true value	Recovery %
Known SRM: Mercury	ug/g	1.53	1.44	106.
Known SRM: Mercury	ug/g	1.31	1.44	91.0
Known SRM: Mercury	ug/g	1.18	1.44	81.9
Known SRM: Mercury	ug/g	1.53	1.47	104.

BLANKS		Result
BLANK: Total Solids	%	< 0.1
BLANK: Total Solids	%	< 0.1
BLANK: Mercury	ug/g	< 0.02
BLANK: Mercury	ug/g	< 0.02
BLANK: Mercury	ug/g	< 0.02
BLANK: Mercury	ug/g	< 0.02

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14603 N.E. 87th St.
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98052
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ANALYSIS REPORT

Ash Grove Cement Company
Western Region
3801 East Marginal Way South
Seattle, WA 98134
Attention: Patrick Noon

Date Received: 4/ 8/97
Date Reported: 4/29/97

Project Name: Ash Grove Seattle
Date Sampled: 3/25/97

PARAMETER	UNITS	DILUTION	RESULT	M.D.L.
97-A004759				
Client ID: 0411-97 Water				
Volume	(mls)		270	
METALS				
Mercury	(ug)	1	< 0.03	0.027
97-A004760				
Client ID: 0412-97F Water				
Volume	(mls)		265	
METALS				
Mercury	(ug)	1	< 0.03	0.026
97-A004761				
Client ID: 0413-97F Water				
Volume	(mls)		270	
METALS				
Mercury	(ug)	1	< 0.03	0.027

M.D.L. - Method Detection Limit

Reported by: Kathy Fugiel

AMTEST

Quality Control Summary

QC for 9708166
97-A004759
97-A004760
97-A004761

DUPLICATES		sample value	duplicate value	RPD %
97-A004759 DUP: Mercury	ug	< 0.0001	< 0.0001	

MATRIX SPIKES		sample value	sample+spk value	spike value	Recovery %
97-A004760 SPIKE: Mercury	ug	< 0.0001	0.0056	0.0050	112.

STANDARD REFERENCE MATERIALS		measured value	true value	Recovery %
Known SRM: Mercury	ug	0.0056	0.0050	112.

BLANKS		Result
BLANK: Mercury	ug	< 0.0001

ASH GROVE CEMENT SEATTLE

Chief Chemist: Patrick Noon
Date: April 8, 1997

CHAIN OF CUSTODY FORM
HAPS TESTING SAMPLES

To Be Delivered to Cathy Fugiel
Amtest Laboratory Redmond, WA

Note Duplicates to be run on 10% of the Samples.
Note Matrix Spikes to be run on 5 run on 10% of the Samples.

SEATTLE NUMBER	MATERIAL	SOURCE OR MFG SOURCE	MILL	TYPE	DATE SAMPLED	DATE DELIVERED	COMMENT Sampling times, comments, etc.	Initials Sample Taken By	Samples Received By
RAW MILL UP TESTING SERIES									
STACK TEST #1 RAW MILL RUNNING									
0411-97A 4731	KILNFEED	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 08:00,09:00,10:00		
0411-97B 4732	RETURN DUST	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 08:00, 10:00		
0411-97C 4733	CLINKER	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 08:00, 09:00, 10:00		
0411-97D 4734	COAL	QUINSAM?	12	WHOLE COAL	25-Mar-97	08-Apr97	COMPOSITE 08:00		
0411-97E 4735	TIRE	TOYO		TDF	25-Mar-97	08-Apr97	GRAB 09:00		
0411-97F 4759	WATER	AGC SEATTLE		WATER	25-Mar-97	08-Apr97	GRAB WATER SAMPLE TO RAW MILL 08:00		
0411-97G 4736	RAWMIX	AGC SEATTLE		I	25-Mar-97	08-Apr97	GRAB SAMPLE 08:00		
STACK TEST #2 RAW MILL RUNNING									
0412-97A 4737	KILNFEED	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 12:00,13:00,14:00		
0412-97B 4738	RETURN DUST	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 12:00,14:00		
0412-97C 4739	CLINKER	AGC SEATTLE		I	25-Mar-97	08-Apr97	COMPOSITE 12:00,13:00,14:00		
0412-97D 40	COAL	QUINSAM?	12	WHOLE COAL	25-Mar-97	08-Apr97	COMPOSITE 12:00		
0412-97F 4760	WATER	AGC SEATTLE		WATER	25-Mar-97	08-Apr97	COMPOSITE 12:00		
0412-97G 41	RAWMIX	AGC SEATTLE		I	25-Mar-97	08-Apr97	GRAB SAMPLE 12:00		
STACK TEST #3 RAW MILL RUNNING									
0413-97A 42	KILNFEED	AGC SEATTLE		I	26-Mar-97	08-Apr97	COMPOSITE 13:00,14:00,15:00		
0413-97B 43	RETURNDUST	AGC SEATTLE		I	26-Mar-97	08-Apr97	COMPOSITE 13:00,15:00		
0413-97C 44	CLINKER	AGC SEATTLE		I	26-Mar-97	08-Apr97	COMPOSITE 13:00,14:00,15:00		
0413-97D 45	COAL	QUINSAM?	12	WHOLE COAL	26-Mar-97	08-Apr97	GRAB SAMPLE 13:00		
0413-97F 4761	WATER	AGC SEATTLE		WATER	26-Mar-97	08-Apr97	GRAB SAMPLE 13:00		
0413-97G 46	RAWMIX	AGC SEATTLE		I	26-Mar-97	08-Apr97	GRAB SAMPLE 13:00		
RAW MILL DOWN TESTING SERIES									
STACK TEST #1 RAW MILL DOWN									
0431-97A 47	KILNFEED	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 08:00,09:00,10:00		
0431-97B 48	RETURN DUST	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 08:00,10:00		
0431-97C 49	CLINKER	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 08:00,09:00,10:00		
0431-97D 50	COAL	QUINSAM?	12	WHOLE COAL	27-Mar-97	08-Apr97	GRAB SAMPLE 08:00		
STACK TEST #2 RAW MILL DOWN									
0432-97A 51	KILNFEED	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 12:00,13:00		
0432-97B 52	RETURNDUST	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 12:00,13:00		
0432-97C 53	CLINKER	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 12:00,13:00		
0432-97D 54	COAL	QUINSAM?	12	WHOLE COAL	27-Mar-97	08-Apr97	GRAB SAMPLE 12:00		
STACK TEST #3 RAW MILL DOWN									
0433-97A 55	KILNFEED	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 15:00,17:00		
0433-97B 56	RETURNDUST	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 15:00,16:00		
0433-97C 57	CLINKER	AGC SEATTLE		I	27-Mar-97	08-Apr97	COMPOSITE 15:00,16:00		
0433-97D 58	COAL	QUINSAM?	12	WHOLE COAL	27-Mar-97	08-Apr97	GRAB SAMPLE 15:00		

S300692

4/8/97 PW/MB

4/8/97

AGCS2M003277

APPENDIX C

Ash Grove Cement Company's Process Data

ASH GROVE CEMENT COMPANY

WESTERN REGION
6720 S.W. MACADAM AVE., SUITE 300
PORTLAND, OREGON 97219-2312
(503) 293-2333

April 17, 1997

Judy Aasland
AmTest Air Quality, LLC
30545 84th St., #5
Preston, WA 98050

Re: Process Data for Ash Grove Source Test Reports

Dear Judy:

Please find attached process data relevant to the recent Seattle source test conducted by AmTest. I assume you will include this data as one of the appendices to the test report.

If you have any questions please call me at (503) 293-2333.

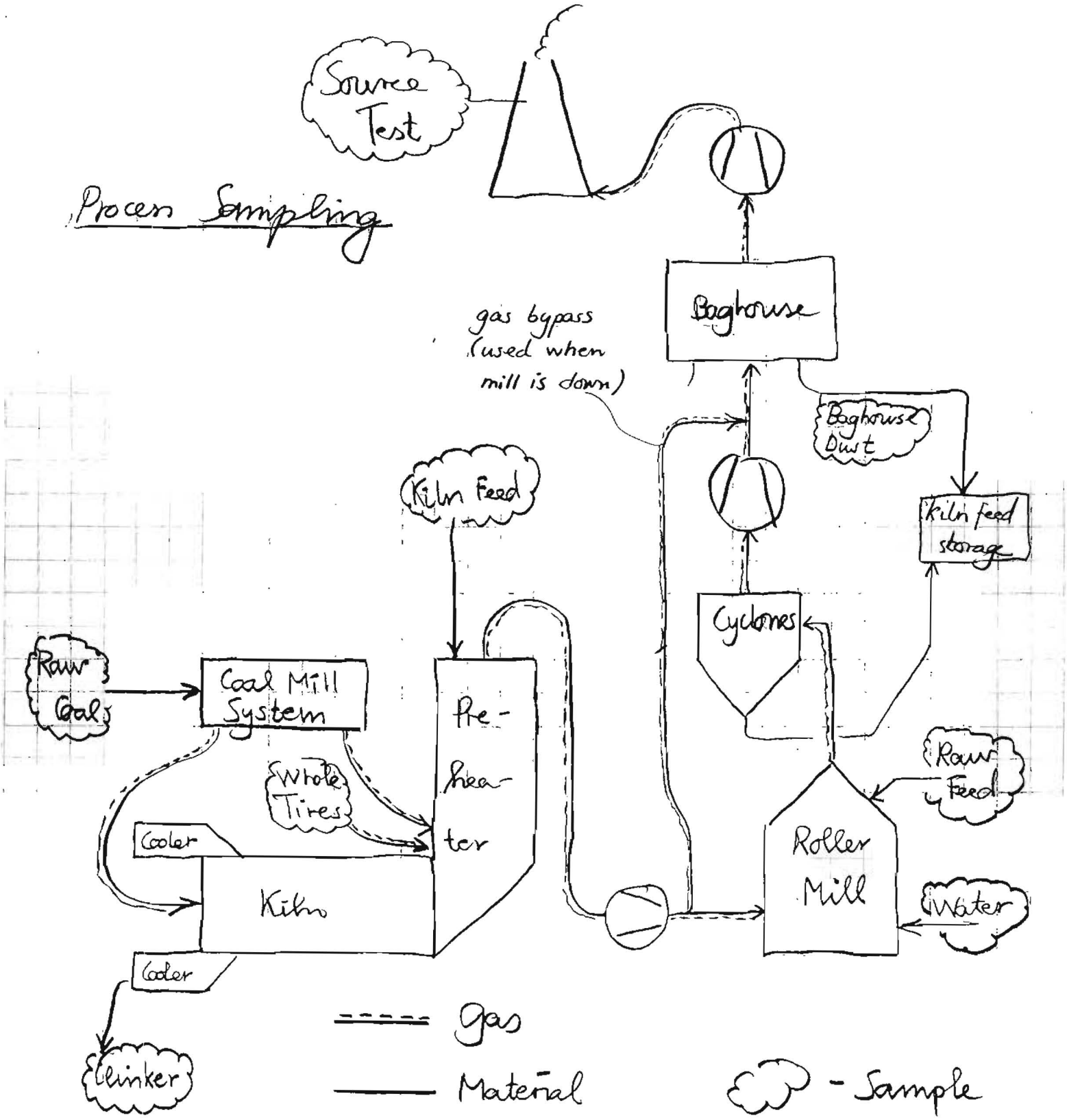
Sincerely,

Hans E. Steuch
Director of Engineering

ASH GROVE CEMENT COMPANY

PROJECT: Seattle HAPs JOB NO: DATE: 5/16/97 BY: KEJ PAGE 1 OF 1

Procen Sampling



Ash Grove Cement Company, Seattle Plant
HAPs Test Baghouse Inlet Temperature and Material Throughput Rates

Process Condition	Roller Mill Running			Roller Mill Down			
Run #	1	2	4	5	6	7	Notes
Date	3/25/97	3/25/97	3/26/97	3/27/97	3/27/97	3/27/97	
EPA Source Test Method	101A						
Time	0700-0910	1045-1327	1313-1550	0700-0923	1045-1259	1450-1710	
Baghouse Inlet Temp., deg. F	237	230	235	502	496	507	1
Roller Mill Raw Feed, tph	172	205	191	0	0	0	1
Roller Mill Spray Water, tph	3.83	3.83	3.83	0	0	0	2
Kiln Feed, tph	157	156	155	154	154	159	1
Baghouse Return Dust, tph	17.2	20.5	19.1	12.3	12.3	12.7	3
Whole Tires, tph	1.59	1.53	1.08	1.26	1.50	0	1
Raw Coal, tph	9.36	5.78	12.7	11.0	11.6	14.7	4
Clinker, tph	95.0	94.4	93.8	93.2	93.2	96.2	5
EPA Source Test Method	23						
Time	0700-1013	1117-1435	1303-1613	0700-1011	1045-1356	1455-1806	
Baghouse Inlet Temp., deg. F	236	228	235	500	496	504	1
Roller Mill Raw Feed, tph	175	211	191	0	0	0	1
Roller Mill Spray Water, tph	3.83	3.83	3.83	0	0	0	2
Kiln Feed, tph	157	156	155	154	156	160	1
Baghouse Return Dust, tph	17.5	21.1	19.1	12.3	12.5	12.8	3
Whole Tires, tph	1.49	1.58	1.08	1.39	1.36	0.32	1
Raw Coal, tph	8.26	6.58	12.7	10.9	11.6	13.8	4
Clinker, tph	95.0	94.4	93.8	93.2	94.4	96.8	5

1) from process computer report
2) from Nate Fernow: mill spray averages 15 gallons per minute
3) from Nate Fernow: roller mill cyclones are 90 % efficient, kiln preheater top stage is 92 % efficient
4) pulverized coal to kiln and calciner from process computer report *1.03/1.008 for 3.0 % moisture in sampled raw coal and 0.8 % moisture in pulverized coal according to Pat Noon. Natural Gas also in use.
5) kiln feed*0.92/1.52

4/17/97, 3:51 PM, 970417A.XLS

FLS Automation 3 Apr 1997 Ver 4.2a B 15.59.31 Ash Grove Cement Wes

Plant Report 23 SPARE Demand Report 24 Mar 97 - 25 Mar 97

FLOW RATE NAT.GAS CALCIN..... .....FLOW RATE NAT'L GAS KILN
FLOW RATE KILN PF. FEED.....
FLOW RATE CALC. PF.FEED.....
TIRE WEIGH SCALE LB/HR.....
FLOW SUMMATION FEEDERS.....
RAW MEAL TO KILN FEED
BAGHOUSE INLET TEMP.

342030.TI1 05TOTFLW 465075.FI1 463140.FI1 431370.FI1
KILN-FEED 463210.FI1 751210.FI1

H:M	degF	t/h	t/h		t/h	t/h	CFM	CFM
0:00	443	156	-0.2	3274.8	1.00	10.5	0	87
1:00	219	155	158.9	3197.8	0.87	10.5	0	86
2:00	230	161	162.7	3256.8	0.67	10.5	0	86
3:00	233	164	169.5	3276.7	0.50	10.5	1	87
4:00	347	164	-0.2	2476.6	0.65	10.3	0	57
5:00	446	162	-0.2	3276.7	0.70	10.2	0	87
6:00	227	160	164.4	3062.7	0.65	10.1	1	87
7:00	226	160	164.6	3276.7	0.51	10.1	1	87
8:00	431	161	-0.2	3208.8	0.51	10.1	0	86
9:00	218	158	163.8	3276.7	0.52	9.8	0	86
10:00	232	154	175.3	3073.8	0.51	10.5	0	86
11:00	443	156	0.5	3062.7	0.51	10.9	0	86
12:00	216	154	163.7	3276.7	0.61	11.1	0	86
13:00	470	158	-0.2	3263.8	0.61	11.1	0	86
14:00	473	154	-0.2	3276.7	0.51	11.3	0	86
15:00	466	155	-0.2	3080.8	0.51	11.3	0	86
16:00	204	152	171.7	3230.8	0.51	11.4	0	86
17:00	235	162	165.8	3131.8	0.51	10.9	0	86
18:00	422	156	-0.2	3276.7	0.51	10.1	0	86
19:00	449	156	-0.2	3276.7	0.51	10.1	0	86
20:00	455	157	-0.1	3276.7	0.60	10.5	0	86
21:00	464	154	-0.2	3276.7	0.60	10.6	0	86
22:00	464	156	-0.2	3102.8	0.60	10.3	0	86
23:00	461	151	-0.2	3276.7	0.60	11.2	0	87
0:00	423	152	-0.2	3276.7	0.61	11.2	0	86

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Plant Report 25 SPARE Demand Report 25 Mar 97 - 26 Mar 9?

FLOW RATE NAT.GAS CALCIN.... FLOW RATE NAT.GAS KILN
FLOW RATE KILN PF. FEED.
FLOW RATE CALC. PF.FEED
TIRE WEIGH SCALE LB/HR.
FLOW SUMMATION FEEDERS...
RAW MEAL TO KILN FEED
BAGHOUSE INLET TEMP

342036.FIL OSTOTFLW 465073.FIL 463140.FIL 461670.FIL
KILN-FEED 463210.FIL 751210.FIL

H:M	°gF	t/h	t/h	t/h	t/h	CFM	CFM
0:00	420	152	-0.2	3276.7	0.61	11.2	0	86
1:00	319	156	164.9	2930.7	0.61	11.2	0	86
2:00	316	155	167.1	3168.8	0.52	10.8	0	86
3:00	314	161	142.0	3276.7	0.52	10.3	0	87
4:00	315	158	167.3	3276.7	0.52	10.6	0	87
5:00	316	160	168.5	3109.8	0.52	10.6	0	87
6:00	280	158	167.0	3276.7	0.52	10.6	0	86
7:00	278	157	160.4	3276.7	0.60	10.7	0	86
8:00	257	154	171.9	3259.8	0.61	11.0	0	86
9:00	257	159	172.3	3109.8	0.61	6.1	0	683
10:00	235	159	179.7	2942.6	0.61	5.3	0	685
11:00	225	160	190.5	3276.7	0.61	5.0	0	685
12:00	235	156	199.8	3276.7	0.61	5.0	0	685
13:00	225	156	210.7	2942.7	0.61	5.1	0	685
14:00	216	154	215.7	3276.7	0.52	5.9	0	547
15:00	235	157	215.8	3276.7	0.52	7.5	0	422
16:00	349	157	0.2	3276.7	0.52	7.6	0	421
17:00	450	158	2.4	2842.7	0.52	9.7	0	145
18:00	459	158	2.4	2999.7	0.52	10.5	0	86
19:00	510	161	2.3	2813.7	0.97	10.2	0	86
20:00	207	155	151.5	1967.9	0.97	9.0	0	86
21:00	272	158	180.7	3276.7	0.97	10.0	0	86
22:00	286	161	179.3	2831.7	0.97	9.8	0	86
23:00	297	159	180.4	3016.8	1.01	9.6	0	87
0:00	232	160	179.3	3168.8	1.01	9.5	0	101

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— M101A, Run #1

— M23, Run #1

— M101A, Run #2

— M23, Run #2

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Plant Report 23 SPARE Demand Report 26 Mar 97 - 27 Mar 97

FLOW RATE NAT.GAS CALCIN.....
FLOW RATE KILN PF. FEED.....
FLOW RATE CALC. PF.FEED.....
TIRE WEIGH SCALE LB/HR.....
.....
FLOW SUMMATION FEEDERS.....
RAW MEAL TO KILN FEED
BAGHOUSE INLET TEMP.

.....FLOW RATE NAT'L GAS KILN

H:M	342030.TI1 degF	05TOTFLW KILN-FEED t/h	465075.FI1 t/h	463140.FI1 t/h	431370.FI1 t/h	465210.FI1 t/h	751210.FI1 t/h	CFM	CFM
0:00	237	165	179.8	3160.8	1.01	9.5	0	101	
1:00	237	154	178.9	3276.7	1.01	9.5	0	102	
2:00	236	160	180.2	3267.8	1.01	10.0	0	101	
3:00	236	162	180.9	3138.8	1.01	10.0	0	101	
4:00	237	162	181.6	3208.8	1.01	10.1	0	102	
5:00	238	159	179.4	3276.7	1.01	10.3	0	102	
6:00	239	163	180.0	3014.7	1.01	10.1	0	102	
7:00	327	156	185.4	3276.7	1.01	9.9	0	102	
8:00	466	159	-0.2	3276.7	1.01	9.9	0	101	
9:00	444	155	-0.2	2959.7	1.12	10.5	0	101	
10:00	449	155	-0.2	3219.8	1.12	10.2	0	101	
11:00	452	156	-0.2	2457.6	1.12	10.4	0	101	
12:00	445	156	-0.2	0.0	3.04	10.5	0	100	
13:00	230	150	179.8	3276.7	1.22	10.5	0	100	
14:00	237	153	195.7	3230.8	1.22	10.5	1	101	
15:00	232	156	197.0	3276.7	1.22	10.5	1	102	
16:00	236	156	172.2	0.0	3.53	10.4	1	102	
17:00	226	152	186.0	3094.8	1.21	10.4	1	101	
18:00	213	157	199.5	2853.7	1.21	10.4	1	102	
19:00	224	160	196.9	3153.8	1.01	10.3	1	102	
20:00	225	162	206.0	2765.7	1.01	10.3	1	102	
21:00	235	156	196.1	2883.7	1.21	9.8	1	102	
22:00	238	163	183.0	3276.7	1.17	9.6	0	102	
23:00	239	157	186.3	2622.6	1.12	9.2	1	102	
0:00	232	162	185.0	0.0	3.15	9.3	1	102	

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-M101A, Run #4 & M23, Run #4

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Plant Report 23 SPARE Demand Report 27 Mar 97 - 28 Mar 97

FLOW RATE NAT.GAS CALCIN . . . . . FLOW RATE NAT'L GAS KILN
FLOW RATE KILN PF. FEED. . . . . .
FLOW RATE CALC. PF.FEED. . . . . .
TIME WEIGH SCALE LB/HR. . . . . .
. . . . . .
FLOW SUMMATION FEEDERS. . . . . .
RAW MEAL TO KILN FEED . . . . . .
BAGHOUSE INLET TEMP . . . . . .

342030.FIL 05TOTFLW 465075.FIL 463140.FIL 431570.FIL
KILN-FEED 465210.FIL 751210.FIL

H:M	degF	t/h	t/h		t/h	t/h	CFM	CFM	
0:00	232	162	185.6	0.0	3.15	9.3	1	102	3/27
1:00	236	163	176.5	0.0	3.24	9.4	1	102	
2:00	238	160	182.3	0.0	3.24	9.4	1	102	
3:00	239	154	180.3	0.0	3.24	9.7	1	102	
4:00	238	159	181.1	0.0	3.43	9.9	1	102	
5:00	237	157	180.1	2454.0	2.05	9.5	1	102	
6:00	236	157	171.3	0.0	1.52	10.0	1	102	
7:00	460	157	-0.2	2736.7	1.11	9.9	1	93	
8:00	507	153	-0.2	2670.7	1.11	9.6	0	90	— M101A, Run #5
9:00	497	155	-0.2	2369.6	1.11	9.7	0	90	
10:00	496	153	-0.3	3276.7	1.02	9.9	0	90	— M23, Run #5
11:00	498	151	-0.3	2783.7	1.01	9.7	0	90	
12:00	503	152	-0.3	2725.7	1.01	10.3	0	90	— M101A, Run #6
13:00	488	155	-0.2	3276.7	1.0.	10.4	0	90	
14:00	496	160	-0.2	2183.5	1.37	10.3	0	90	— M23, Run #6
15:00	493	159	-0.2	0.0	3.25	10.7	0	90	
16:00	512	156	-0.2	0.0	3.14	11.1	0	90	— M101A, Run #7
17:00	502	161	-0.2	0.0	3.14	11.4	0	90	
18:00	493	162	-0.2	1908.5	0.71	11.0	0	90	— M23, Run #7
19:00	281	0	-0.2	0.0	0.00	0.0	0	90	
20:00	189	0	-0.2	0.0	0.00	0.0	1	25	
21:00	186	0	-0.2	0.0	0.00	0.0	1	25	
22:00	214	0	-0.2	0.0	0.00	0.0	1	25	
23:00	228	0	-0.2	0.0	0.00	0.0	1	25	
0:00	219	0	-0.2	0.0	0.00	0.0	1	25	

FLS Automation 3 Apr 1997 Ver 4.2a 8 16.01.45 Ash Grove Cement Wes

Plant Report 23 SPARE Demand Report 28 Mar 97 - 29 Mar 97

FLOW RATE NAT.GAS CALCIN .....
FLOW RATE KILN PF. FEED.....
FLOW RATE CALC. PF.FEED.....
TIRE WEIGH SCALE LB/HR.....
.....
FLOW SUMMATION FEEDERS.....
RAW MEAL TO KILN FEED
BAGHOUSE INLET TEMP.

.....FLOW RATE NAT'L GAS KILN

	342030.TI1	05TOTFLW	465075.FI1	463140.FI1	431370.FI1			
		KILN-FEED		463210.FI1	751210.FI1			
H:M	degF	t/h	t/h	t/h	t/h	t/h	CFM	CFM
0:00	219	0	-0.3	0.0	0.00	0.0	1	325
1:00	327	0	-0.3	0.0	0.00	0.0	1	329
2:00	399	72	-0.3	0.0	0.00	0.0	1	336
3:00	366	82	-0.3	0.0	1.76	5.9	1	335
4:00	220	108	183.0	0.0	2.12	8.4	1	282
5:00	233	127	192.9	0.0	2.26	11.4	1	93
6:00	236	164	193.4	0.0	2.26	12.8	1	92
7:00	237	164	195.9	0.0	2.67	11.7	1	92
8:00	237	164	198.3	0.0	2.81	11.5	1	92
9:00	237	162	198.8	0.0	2.81	11.3	0	92
10:00	237	156	201.6	0.0	2.75	11.1	0	92
11:00	239	152	203.2	0.0	2.74	11.4	0	92
12:00	237	152	203.6	0.0	2.75	11.5	0	91
13:00	238	155	201.0	0.0	2.74	11.6	0	91
14:00	237	155	197.9	0.0	2.74	11.4	0	91
15:00	238	157	202.9	0.0	2.75	11.4	0	91
16:00	239	161	200.5	0.0	2.74	11.4	0	92
17:00	235	164	198.5	0.0	2.79	11.0	0	94
18:00	228	165	198.0	0.0	2.75	11.0	0	92
19:00	225	162	196.9	0.0	2.74	10.7	0	92
20:00	233	161	198.2	0.0	2.74	10.3	0	92
21:00	235	163	200.9	0.0	2.84	11.9	0	92
22:00	236	160	198.1	0.0	2.93	11.1	0	92
23:00	237	152	189.1	0.0	2.93	11.3	0	92
0:00	228	159	187.7	0.0	2.93	11.3		92

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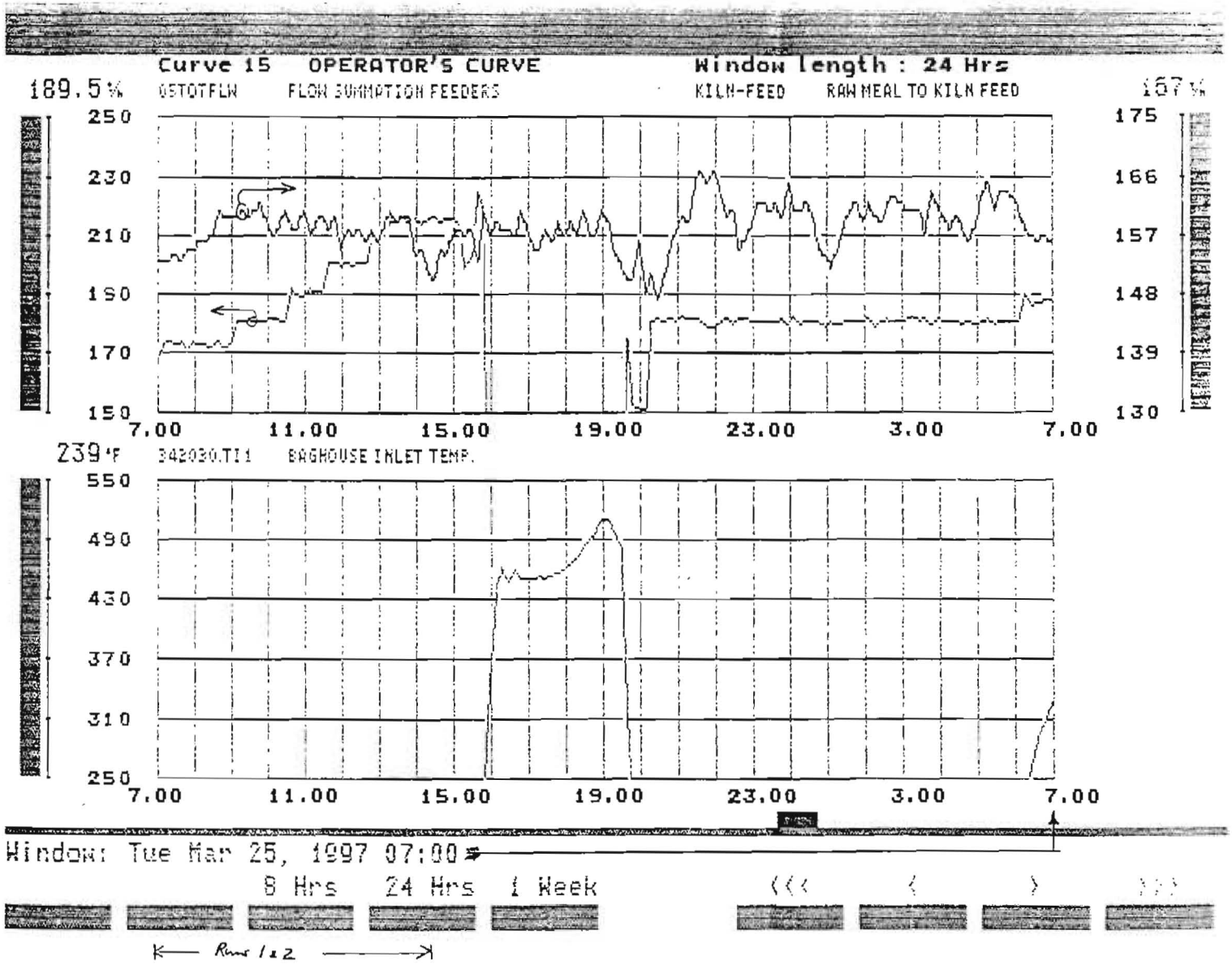

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S300702

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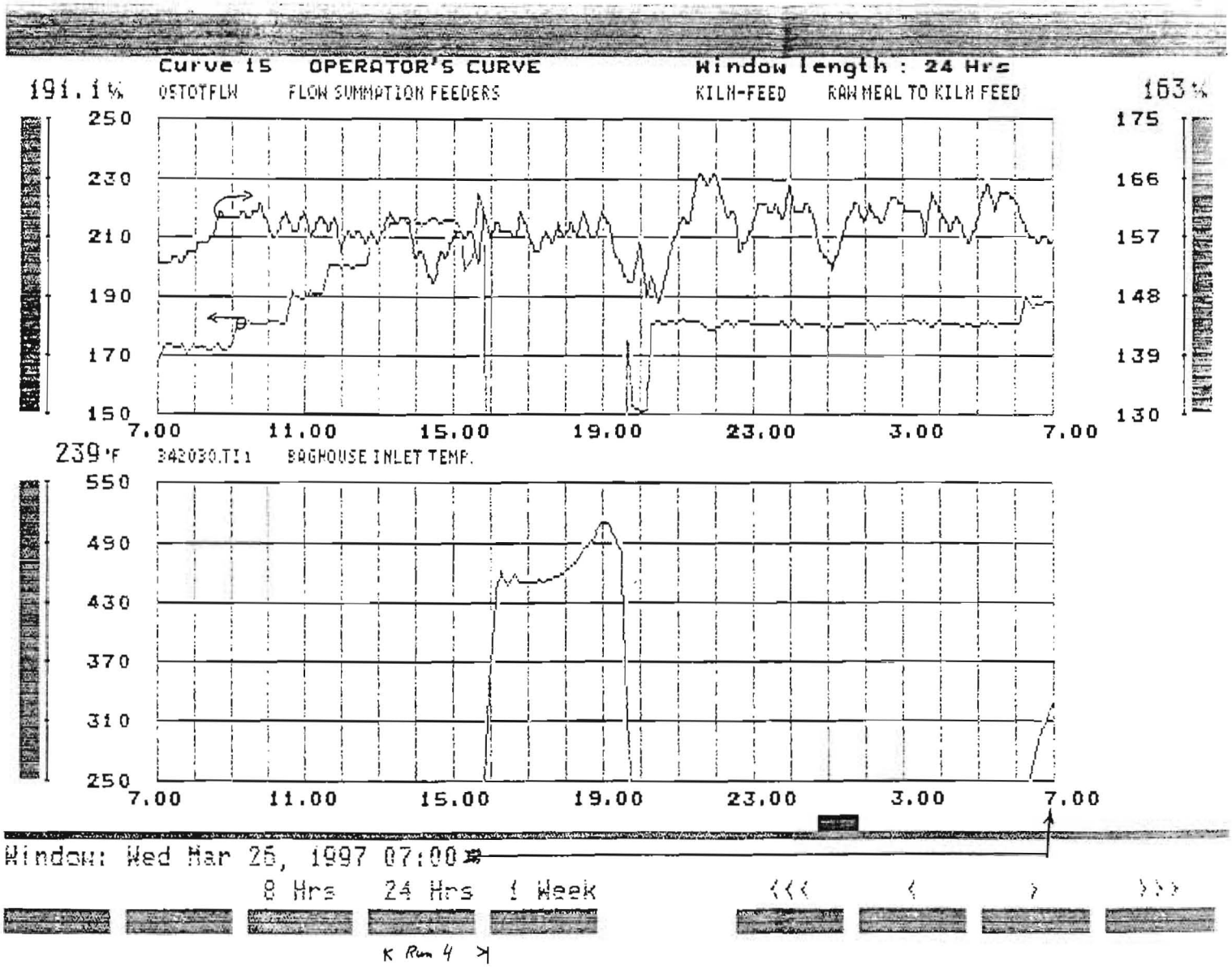

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S300703

156

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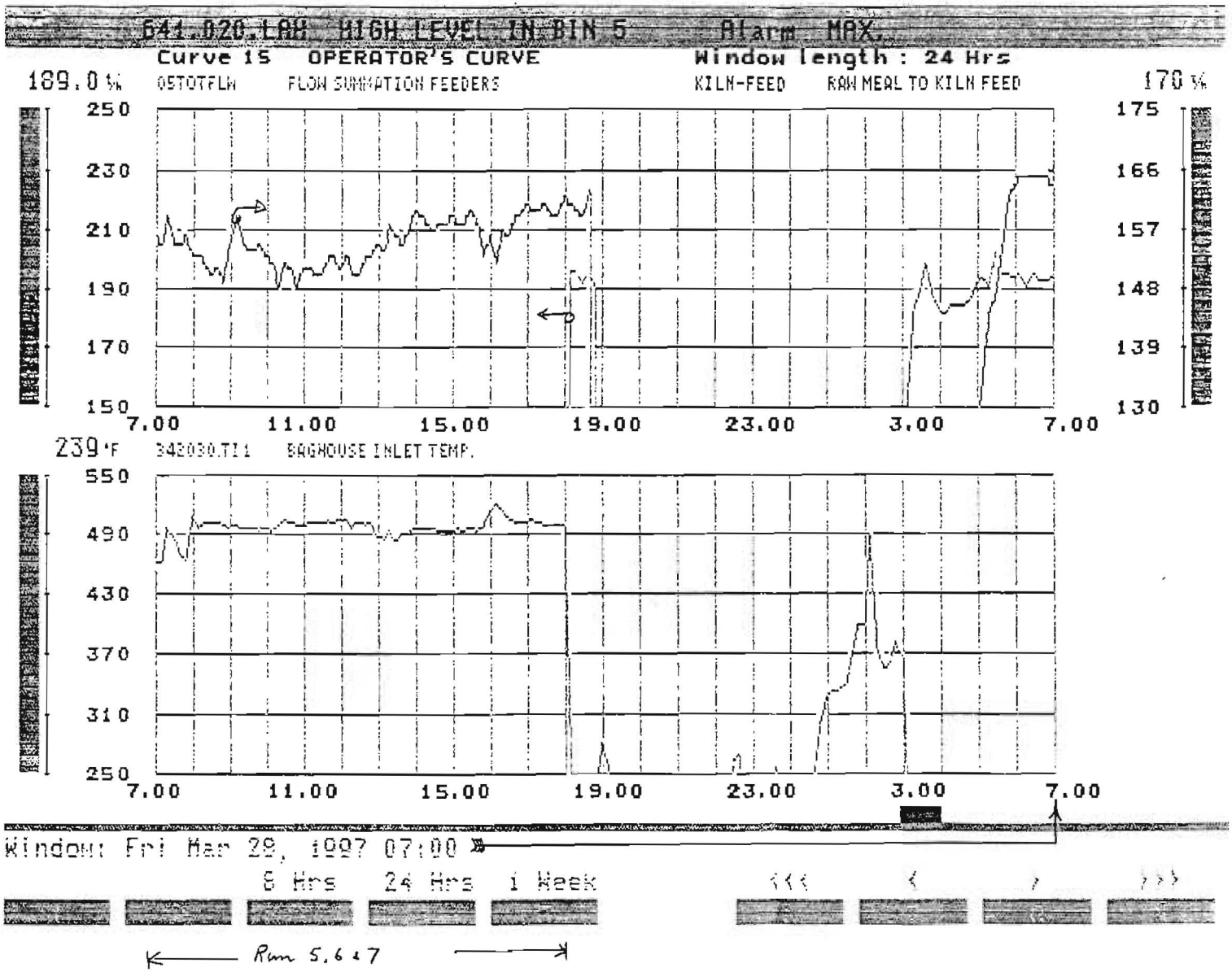

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AGCS2M003289

Memorandum

To: File

CC:

From: Hans E. Steuch HES

Date: May 22, 1997

Re: Baghouse inlet temperature

The baghouse inlet thermocouple is used to indicate baghouse inlet temperature both when the roller mill is in operation and when it is down. Plant records indicate that on March 21, 1997 this thermocouple was calibrated against an ASTM traceable mercury-in-glass thermometer. The thermocouple read 58 deg. F, the thermometer 56 deg. F.

APPENDIX D

Example Calculations & Field Data Sheets

EXAMPLE CALCULATION SHEET
EPA METHODS 1, 2, 3A, AND 4
FOR METHOD 23

CLIENT: Ash Grove Cement Company LOCATION: Seattle, WA DATE: 3/25/97

RUN #: 2 LAB #: 1452 SITE LOCATION: Cement Kiln Main Stack

Dry Gas Volume - Equation 5-1

Vm_{std} =17.647°R/"$Hg_{(constant)}$*volume sampled*Y_{factor}*(P_R+ ΔH/13.6)/(460+T_m)

=17.647°R/"Hg* 120.024 ft^3* 0.976 *(30.05 "Hg + (1.595 "H_2O/13.6))/(460 + 67.6 °F)

= 118.201 **dscf**

dscm = 118.201 dscf/35.31 ft^3/m^3 = 3.348 **dscm**

Moisture - Equation 5-2 and 5-3

Vw_{std} = 0.04715 ft^3/g * 368.7 grams of H_2O collected in impingers = 17.38 **scf**

B_{ws} = (17.38 scf)/(17.38 scf + 118.201 dscf) = 0.1282 B_{ws}

% Moisture = B_{ws} * 100 = 12.82 %

Molecular weight - Equation 3-2

M_d = 0.440*(18.1 %CO_2)+0.320*(10.4 %O_2)+0.280*(100%- 18.1 %CO_2- 10.4 %O_2(%CO+%N_2))

= 31.31 **g/g-mole (dry)**

M_s = M_d * (1-B_{ws}) + 18.0 * B_{ws} = 31.31 g/g-mole * (1 - 0.1282) + 18.0 g/g-mole * 0.1282

= 29.61 **g/g-mole (wet)**

F_o = (20.9 - _____)%O_2/_____%CO_2 = NA

Stack gas velocity and volumetric flow rate - Equation 2-9 and 2-10

V_s = 85.49 * C_p* $\sqrt{\Delta P * T_s°R / (M_s \text{ g/g-mole} * P_s\text{"Hg})}$

= 85.49 * 0.84 * $\sqrt{0.144 * 681.8 \text{ °R} / (29.61 \text{ g/g-mole} * 30.01 \text{ "Hg})}$ = 23.8 **ft/sec (std)**

(221.8 °F + 460)°R (30.05 P_B+ -0.50 P_s/13.6)

Q_{sd} = 60 * (1 - B_{ws}) * V_s ft/sec * A_s ft^2 * (T_{std}°R/T_s°R) * (P_s"Hg / P_{std}"Hg)

= 60 * (1 - 0.1282) * 23.8 ft/sec * 132.7 ft^2 * (528°R/ 681.8 °R) * (30.01 "Hg / 29.92"Hg)

(156 S_{dia}/12/2)^2*π

= 128585 **dscf/min (dry standard cubic feet per minute)**

acfm = 23.8 ft/sec * 132.7 ft^2 * 60 sec/min = 189855 **acfm (actual cubic feet per minute)**

All of the above numbered equations are from the 40 CFR 60 and assume English units.

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Meter Box Calibration Error

$$Y_{qa} = \frac{\theta}{V_m} * \sqrt{\frac{0.0319 * T_m * \Delta H_{avg} * 29}{\Delta H_@ * (Pb + \Delta H_{avg}/13.6) * M_d}}$$

$$Y_{qa} = \frac{180.0 \text{ min}}{120.024 \text{ dcf}} * \sqrt{\frac{0.0319 * (67.6 \text{ °F} + 460\text{°R}) * 1.595 \ \Delta H_{avg} * 29 \text{ g/g-mole}}{1.910 \ \Delta H_@ * (30.05 \text{ "Hg} + 1.595 \ \Delta H_{avg}/13.6) * 31.31 \text{ g/g-mole}}}$$

$$= 0.985$$

% Error = (0.985 Y_{qa} - 0.976 Y) / 0.985 Y_{qa} * 100% = 0.9 %

Percent error must be less than 5%

Isokinetic variation - Equation 5-8

$$I = \frac{0.0945 * Vm_{std} \text{ dscf} * T_s \text{°R}}{[P_s \text{"Hg} * V_s \text{ft/sec} * \text{minutes} * A_n \text{ft}^2 * (1 - B_{ws})]}$$

$$= \frac{0.0945 * 118.201 \text{ dscf} * 681.8 \text{ °R}}{[30.01 \text{ "Hg} * 23.8 \text{ ft/sec} * 180.0 \text{ min} * \frac{0.0007 \text{ ft}^2}{(0.356 N_{dia}/12/2)^2 * \pi} * (1 - 0.1282)]}$$

$$= 98 \%$$

All of the above numbered equations are from the 40 CFR 60 and assume English units.

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AMTEST AIR QUALITY, LLC

EXAMPLE CALCULATION SHEET
DIOXINS (PCDDs) and FURANS (PCDFs)

CLIENT: ASH GROVE CEMENT CO. LOCATION: SEATTLE, WASHINGTON DATE: 3/27/97

RUN #: 5 LAB #: 1454 SITE LOCATION: MAIN CEMENT KILN STACK

EXAMPLE COMPOUND: 2,3,7,8 - TCDF

Emission Results

$$\text{ng/dscm} = \frac{83\ \text{pg}}{2.872\ \text{dscm}} * \frac{1}{1} * \frac{1\ \text{ng}}{1000\ \text{pg}}$$

$$= 0.029\ \textbf{ng/dscm}$$

$$\text{ng/dscm @ \% } O_2 = 0.029\ \text{ng/dscm} * \frac{(20.9 - 7.0)}{(20.9 - 7.8)}$$

$$= 0.031\ \textbf{ng/dscm @ \% } O_2$$

$$\text{mg/hr} = 0.029\ \frac{\text{ng}}{\text{dscm}} * \frac{1\ \text{mg}}{1000\ \text{ng}} * \frac{1\ \text{m}^3}{35.31\ \text{ft}^3} * 109104\ \frac{\text{dscf}}{\text{min}} * \frac{60\ \text{min}}{1\ \text{hr}}$$

$$= 5.06\ \textbf{mg/hr}$$

EXAMPLE CALCULATION SHEET
EPA METHODS 1, 2, 3A, AND 4
FOR METHOD 101A

CLIENT: Ash Grove Cement Company LOCATION: Seattle, WA DATE: 3/25/97

RUN #: 2 LAB #: 1458 SITE LOCATION: Cement Kiln Main Stack

Dry Gas Volume - Equation 5-1

Vm_{std} =17.647°R/"$Hg_{(constant)}$*volume sampled*Yfactor*(P_R+ ΔH/13.6)/(460+T_m)

=17.647°R/"Hg* 82.743 ft^3* 0.976 *(30.05 "Hg + (1.854 "H_2O/13.6))/(460 + 72.7 °F)

= 80.757 **dscf**

dscm = 80.757 dscf/35.31 ft^3/m^3 = 2.287 **dscm**

Moisture - Equation 5-2 and 5-3

Vw_{std} = 0.04715 ft^3/g * 255.6 grams of H_2O collected in impingers = 12.05 **scf**

B_{ws} = (12.05 scf)/(12.05 scf + 80.757 dscf) = 0.1299 B_{ws}

% Moisture = B_{ws} * 100 = 12.99 %

Molecular weight - Equation 3-2

M_d = 0.440*(18.1 %CO_2)+0.320*(10.3 %O_2)+0.280*(100%- 18.1 %CO_2- 12.3 %O_2(%CO+%N_2))

= 31.31 **g/g-mole (dry)**

M_s = M_d * (1-B_{ws}) + 18.0 * B_{ws} = 31.31 g/g-mole * (1 - 0.1299) + 18.0 g/g-mole * 0.1299

= 29.58 **g/g-mole (wet)**

F_o = (20.9 - _____)%O_2/_____%CO_2 = NA

Stack gas velocity and volumetric flow rate - Equation 2-9 and 2-10

V_s = 85.49 * C_p* $\sqrt{\Delta P * T_s°R / (M_s \text{ g/g-mole} * P_s\text{"Hg})}$

= 85.49 * 0.84 * $\sqrt{\underset{(225.5°F + 460)°R}{0.154} * \frac{685.5 °R}{(29.58 \text{ g/g-mole} * \underset{(30.05\ P_B + .048\ P_s/13.6)}{30.01} \text{"Hg})}}$ = 24.7 **ft/sec (std)**

Q_{sd} = 60 * (1 - B_{ws}) * V_s ft/sec * A_s ft^2 * (T_{std}°R/T_s°R) * (P_s"Hg / P_{std}"Hg)

= 60 * (1 - 0.1299) * 24.7 ft/sec * 132.7 ft^2 * (528°R/685.5°R) * (30.01 "Hg / 29.92"Hg)
(156 S_{dia}/12/2)^2*π

= 132,425 **dscf/min (dry standard cubic feet per minute)**

acfm = 24.7 ft/sec * 132.7 ft^2 * 60 sec/min = 196,960 **acfm (actual cubic feet per minute)**

All of the above numbered equations are from the 40 CFR 60 and assume English units.

(cbhjc:\winword\byhands\m5ww6.doc)

Meter Box Calibration Error

$$Y_{qa} = \frac{\theta}{V_m} * \sqrt{\frac{0.0319 * T_m * \Delta H_{avg} * 29}{\Delta H@ * (Pb + \Delta H_{avg}/13.6) * M_d}}$$

$$Y_{qa} = \frac{120.0 \text{ min}}{82.743 \text{ dcf}} * \sqrt{\frac{0.0319 * (72.7 \text{ °F} + 460\text{°R}) * 1.854 \Delta H_{avg} * 29 \text{ g/g-mole}}{2.060 \Delta H@ * (30.05 \text{ "Hg} + 1.854 \Delta H_{avg}/13.6) * 31.31 \text{ g/g-mole}}}$$

$$= 0.994$$

% Error = (0.994 Y_{qa} - 0.976 Y)/ 0.994 Y_{qa} * 100% = 1.8 %

Percent error must be less than 5%

Isokinetic variation - Equation 5-8

$$I = \frac{0.0945 * Vm_{std} \text{ dscf} * T_s \text{°R}}{[P_s \text{"Hg} * V_s \text{ft/sec} * \text{minutes} * A_n \text{ft}^2 * (1 - B_{ws})]}$$

$$= \frac{0.0945 * 80.757 \text{ dscf} * 685.5 \text{° R}}{[30.01 \text{ "Hg} * 24.7 \text{ ft/sec} * 120.0 \text{ min} * \underset{(\_\_\_\_ N_{dia}/12/2)^2 * \pi}{\_\_\_\_\_ \text{ft}^2} * (1 - 0.1249)]}$$

$$= 99 \%$$

All of the above numbered equations are from the 40 CFR 60 and assume English units.

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AMTEST AIR QUALITY, LLC

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MERCURY EXAMPLE CALCULATION

ASH GROVE CEMENT COMPANY
SEATTLE, WASHINGTON
MAIN CEMENT KILN STACK
3/27/97
RUN 5

$$1500\,\mu g \times \frac{1000\,ng}{1\,\mu g} \times \frac{1}{1.890\,dscm} = 793651\,ng/dscm\ \text{MERCURY}$$

$$\frac{793651\,ng}{dscm} \times \frac{(20.9\%\,O_2 - 7.0\%\,O_2)}{(20.9\%\,O_2 - 8.1\%\,O_2)} = 861855\,ng/dscm\ \text{MERCURY @ 7\% OXYGEN}$$

$$\frac{793651\,ng}{dscm} \times \frac{1\,\mu g}{1000\,ng} \times \frac{1\,mg}{1000\,\mu g} \times \frac{1\,m^3}{35.31\,ft^3} \times \frac{10.4923\,dscf}{min} \times \frac{60\,min}{1\,hr}$$

$$= 19.499\,mg/hr\ \text{MERCURY}$$

CIRCULAR STACK SCHEMATIC AND LOCATION OF SAMPLE POINTS

Client ASH GROVE CEMENT COMPANY

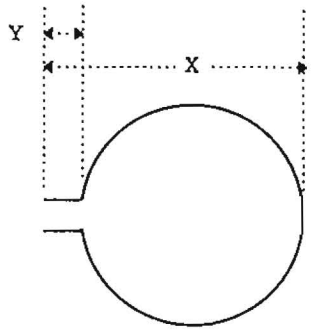
Location SEATTLE, WASHINGTON

Sampling Location CEMENT KILN MAIN STACK

Inside of far wall to outside of port (distance, X) 165"

Inside of near wall to outside of port (distance, Y) 9"

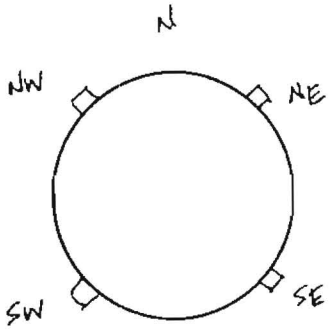
Stack I.D. (distance X - distance Y) 156"



Schematic of Sampling Location

1 Traverse Point #	2 Fractional Percent of Stack I.D.	3 Stack I.D. Inches	4 Column 2 x 3	5 Distance X	6 Traverse Point Location from Outside of Port columns 4 + 5
1	4.4	156"	6.86	9"	15.86"
2	14.6	↓	22.78	↓	31.78"
3	29.6	↓	46.18	↓	55.18"
4					
5					
6					
7					
8					
9					
10					
11					
12					

CROSS SECTION



STACK, CONTROL DEVICE AND PROCESS FLOW DIAGRAM

Stack Height (estimated) = _____

Port Diameter (" I.D.) = _____

Distance A = > 2 DIAMETERS *downstream*

Distance B = > 8 DIAMETERS *upstream*

TRAVERSE SAMPLING DATA SHEET

Lab Number 1451

Client Ash Grove
Location Seattle, WA
Sample Site
MAIN STACK
Stack Diameter 48" Ø 156"
Date 3-25-97
Operators JAG - CM
Run # 1 Method M23

Stack Schematic Completed
Sample Train Info Completed
Pitot # Side
Thermocouple #
Meter Box ID
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set B-2

Start Time 0700 hours
Stop Time 1063 hours
Barometric Press. 30.05 "Hg
Static Press. -0.50 "H_2O
Production Rate
- Raw Mill ON -
Cyclonic Flow Check
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.002	.003
Leak Test Vacuum	17	17
Pitots, Leak Check	✓	
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	(Ace) / H_2O / Other	
Alt. TC Cal.	TC Temp. ocm	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	659.9	-	338.0	=	321.9
#2	447.0	-	447.0	=	0.0
#3	357.3	-	354.6	=	2.7
#4		-		=	
#5		-		=	
SG	788.0	-	761.5	=	26.5
			Total Volume =		351.1 ✓

SAMPLING PARAMETERS

% Moisture 12
Meter Temp. 76.5
Stack Temp. 220
ΔH@ 1.910
Y 0.976
Cp .84
Nozzle Diameter .352 inch
D1 D2 D3
K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
NW 1	0	840.322	.15	1.19	1.19	63	65	5½	249	52	223	10.3	18.3
2	15		.15	1.65	1.65	63	64	5½	250	48	227	10.2	18.6
3	30	859.58	.20	2.17	2.17	64	64	8	251	49	229	10.2	18.4
SW 1	45	871.208	.11	1.19	1.19	65	64	5½	251	51	224	10.2	18.7
2	60	879.780	.19	2.06	2.06	66	65	8	243	50	230	9.8	19.5
3	75	891.14	.19	2.06	2.06	68	66	8	247	51	231	9.1	20.5
SE 1	90	902.691	.12	1.30	1.30	67	67	6½	233	52	222	10.2	18.6
2	105		.15	1.63	1.63	67	66	8	234	52	229	10.2	18.6
3	120	921.55	.18	1.95	1.95	68	67	9	239	55	230	9.9	18.7
NE 1	135	932.813	.11	1.21	1.21	68	67	6	236	58	223	10.2	18.2
2	150		.15	1.63	1.63	69	68	8	250	58	227	10.1	18.0
3	165	951.45	.17	1.87	1.87	70	69	9	255	61	228	10.2	18.2
END	180	962.526											
		122.204 ✓	$(\sqrt{\Delta P_{avg}})^2$	1.659 ✓ ΔH_{avg}		66.2 ✓ Tm					226.9 ✓ Ts	10.1 ✓ O_2 %	18.7 ✓ CO_2 %

S300 AGCS2M003299

TRAVERSE SAMPLING DATA SHEET

Lab Number 1452

Client ASH GROVE
Location SEATTLE - WA
Sample Site MAIN STACK
Stack Diameter ~~165~~ 156"
Date 3-25-97
Operators JBG
Run # 2 Method M23

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm		
Leak Test Vacuum		
Pitots, Leak Check		
Gas Sampling System		
Integrated Bag		
Probe Wash	Ace / H_2O / Other	
Alt. TC Cal.	TC Temp.	
Thermometer ID	Therm Temp.	

Stack Schematic Completed
Sample Train Info Completed
Pitot # Side
Thermocouple #
Meter Box ID
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set B-3

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	1042.1	- 315.4	=
#2	467.3	- 460.5	=
#3	330.8	- 327.8	=
#4		-	=
#5		-	=
SG	799.9	- 767.7	=

Total Volume = 368.7 ✓

Start Time 1117 hours
Stop Time 1435 hours
Barometric Press. 30.05 "Hg
Static Press. -.60 "H_2O
Production Rate
Cyclonic Flow Check
(Attach sheet if applicable)

SAMPLING PARAMETERS

% Moisture
Meter Temp.
Stack Temp.
ΔH@ 1.9 | 0
Y 0.976
Cp .84
Nozzle Diameter .350 inch
D1 D2 D3
K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
NW 1	0	963.655	.11	1.21	1.24	66	67	3	228	58	224	10.3	18.3
2	15	972.21	.14	1.54	1.54	66	65	5	248	56	229	10.2	18.5
3	30	982.37	.17	1.87	1.87	68	67	6½	252	60	230	10.2	18.3
SW 1	45	993.830	.11	1.21	1.21	68	67	5	247	61	229	10.3	18.2
2	60	1002.10	.17	1.87	1.87	69	68	7	254	60	229	10.5	18.1
3	75	13.050	.18	1.98	1.98	69	68	7	246	62	231	10.0	18.8
SE 1	90	24.328	.10	1.10	1.10	68	68	5	237	65	220	10.2	18.2
2	105	32.72	.15	1.65	1.65	68	67	7	250	63	220	10.2	18.2
3	120	43.10	.18	1.98	1.98	69	68	8	264	64	216	10.5	17.9
NE 1	135	53.854	.12	1.32	1.32	68	68	5	243	65	205	10.7	18.2
2	150	62.95	.15	1.65	1.65	68	67	6	246	65	212	10.8	18.0
3	165	73.20	.16	1.76	1.76	68	67	7	260	64	216	11.0	17.0
END	180	1083.679											
		120.024 ✓	$(\sqrt{\Delta P_{avg}})^2$		1.595 ✓ ΔH_{avg}		67.6 ✓ Tm				221.8 ✓ Ts	10.4 ✓ O_2 %	18.1 ✓ CO_2 %

TRAVERSE SAMPLING DATA SHEET

Lab Number 1453

Client: Ash Grove	Stack Schematic Completed: ✓	Start Time: 1303 hours
Location: Seattle WA	Sample Train Info Completed: ✓	Stop Time: 1613 hours
Sample Site: Main Stack	Pitot #: PSK Side: A	Barometric Press.: 29.80 "Hg
	Thermocouple #: TSK	Static Press.: -0.50 "H_2O
Stack Diameter: 156"	Meter Box ID: JAG Orange	Production Rate:
Date: 3-26-97	Pressure Meas. Device	
Operators: PSC	(Mag) / Man. / S.R. I.D. JAG Orange	Cyclonic Flow Check:
Run #: 4 Method: M-23	Filter #: Imp. Set: B-2	(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	0.003	0.004
Leak Test Vacuum	15"	15"
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	Ace / H_2O / (Other)	
Alt. TC Cal.	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	636.3	340.3	296.0
#2	450.0	452.0	-2.0
#3	356.9	355.2	1.7
#4			
#5			
SG	816.4	790.4	26.4
		Total Volume =	321.7 ✓

SAMPLING PARAMETERS

% Moisture	12
Meter Temp.	60
Stack Temp.	250
ΔH@	1.910
Y	.976
Cp	.841
Nozzle Diameter	.356 inch
D1 / D2 / D3	
K Factor	

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2 %
NW 3	0	113.982	.17	1.53	1.53	59	59	6	247	54	253	9.7	19.4
2	15	124.780	.16	1.75	1.75	60	59	6	247	52	247	9.4	20.5
1	30	135.250	.13	1.43	1.43	61	60	6	250	53	242	9.6	20.1
SW 3	45	146.025	.18	2.00	2.00	61	60	6	242	53	236	9.8	20.1
2	60	156.035	.17	1.88	1.88	60	58	6	239	49	238	9.6	20.0
1	75	167.060	.11	1.23	1.23	60	58	6	242	48	230	9.6	20.0
SE 3	90	175.702	.16	1.79	1.79	59	58	6	246	49	230	9.8	19.6
2	105	186.415	.15	1.69	1.69	59	58	6	248	48	226	9.5	20.3
1	120	196.920	.12	1.36	1.36	59	58	6	250	49	223	9.9	18.9
NE 3	135	206.007	.17	1.92	1.92	58	57	6	253	47	222	9.6	19.8
2	150	216.555	.13	1.46	1.46	57	56	6	249	47	224	9.8	19.9
1	165	226.620	.11	1.24	1.24	57	55	6	250	48	223	10.1	19.5
	180	235.564											

XAD <68

Dry Gas Meter total	121.582	
$(\sqrt{\Delta P_{avg}})^2$	0.146	
ΔH_{avg}	1.640	
T_m	58.6	
Stack Temp. avg	232.8	
O_2 %	9.7	
CO_2 %	19.8	

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TRAVERSE SAMPLING DATA SHEET

Lab Number 1454

Client: Ash Grove	Stack Schematic Completed:	Start Time: 0700 hours
Location: Seattle	Sample Train Info Completed:	Stop Time: 1011 hours
Sample Site: Main Stack	Pitot #: Side:	Barometric Press.: 30.00 "Hg
	Thermocouple #:	Static Press.: -0.65 "H_2O
Stack Diameter: 152" ø	Meter Box ID: Orange #1	Production Rate:
Date: 3-27-97	Pressure Meas. Device:	Raw Mill OFF
Operators: JMG	(Mag.) / Man. / S.R. I.D.	Cyclonic Flow Check:
Run # 5 Method M-23	Filter #: Imp. Set B-2	(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	<.02	.003
Leak Test Vacuum	15	10
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		

Probe Wash: Ace / H_2O / Other

Alt. TC Cal. TC Temp.

Thermometer ID Therm Temp.

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	514.6	319.9	
#2	448.0	447.6	
#3	335.2	334.6	
#4			
#5			
SG	895.5	875.2	

Total Volume = 216.0 ✓

SAMPLING PARAMETERS

% Moisture: 5

Meter Temp.: 53

Stack Temp.: 350

ΔH@: 1.91

Y: 0.976

Cp: .84

Nozzle Diameter: .356 inch

D1 D2 D3

K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
NW 3	0	235.947	.17	1.80	1.80	51	51	5	281	49	362	9.3	20.8
2	15	246.57	.11	1.14	1.14	52	51	5	266	47	346	7.6	24.2
1	30	254.92	.06	.62	.62	53	52	4	266	47	367	7.3	23.9
SW 3	45	261.033	.14	1.45	1.45	54	52	6	252	47	386	8.5	21.6
2	60	270.30	.11	1.10	1.10	56	54	5	261	45	403	7.9	22.8
1	75	278.65	.08	.80	.80	57	55	5	262	46	400	7.9	22.8
SE 3	90	285.715	.14	1.45	1.45	57	56	6	260	47	412	7.8	22.6
2	105	293.1	.15	1.50	1.50	58	57	6	257	46	423	8.0	22.0
1	120	305.01	.085	.85	.85	59	57	5	253	48	410	7.4	23.4
NE 3	135	312.425	.14	1.45	1.45	57	57	6	269	49	416	7.5	23.2
2	150	321.77	.11	1.10	1.10	58	58	6	260	51	421	7.1	23.9
1	165	330.14	.07	.70	.70	57	57	5	260	51	412	7.1	23.8
end	180	336.792											

100.845 ✓ $(\sqrt{\Delta P_{avg}})^2$ 1.163 ✓ ΔH_{avg} 55.3 ✓ Tm 398.2 ✓ Ts 7.8 ✓ O_2 % 22.9 ✓ CO_2 %

TRAVERSE SAMPLING DATA SHEET

Lab Number 1455

Client ASH GROVE
Location SEATTLE, WA
Sample Site MAIN STACK
Stack Diameter 156" ϕ
Date 3-27-97
Operators JAG
Run # 4 Method M-23

Stack Schematic Completed
Sample Train Info Completed
Pitot # Side
Thermocouple #
Meter Box ID
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set B-3

Start Time 1045 hours
Stop Time 1357 hours
Barometric Press. 30.00 "Hg
Static Press. -.65 "H_2O
Production Rate
RAW MILL OFF
Cyclonic Flow Check
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	1.02 ✓	.005 ✓
Leak Test Vacuum	15 ✓	15 ✓
Pitots, Leak Check	✓	
Gas Sampling System	✓	
Integrated Bag		

Probe Wash Ace / H_2O / Other
Alt. TC Cal. TC Temp.
Thermometer ID Therm Temp.

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	510.4	317.2	
#2	466.6	461.4	0.1
#3	330.1	328.6	1.5
#4			
#5			
SG	846.7	822.7	24.0

Total Volume = 218.8 ✓

SAMPLING PARAMETERS

% Moisture
Meter Temp.
Stack Temp.
ΔH@ 1.91
Y 0.976
Cp .84
Nozzle Diameter .353 inch
D1 D2 D3
K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
NW 3	0	336.987	.12	1.20	1.20	54	54	5	267	53	426	7.3	23.1
2	15	345.03	.115	1.12	1.12	55	54	5	267	51	427	7.3	23.1
1	30		.075	.73	.73	57	55	5	267	51	424	7.4	23.2
SW 3	45	360.385	.12	1.20	1.20	58	56	6	270	51	423	7.3	22.8
2	60	369.50	.11	1.08	1.08	61	57	5	268	48	432	7.2	22.7
1	75	377.10	.08	.78	.78	61	59	5	267	50	424	7.4	22.8
SE 3	90	384.070	.13	1.27	1.27	61	60	7	251	50	424	7.2	23.1
2	105	392.79	.13	1.27	1.27	60	60	7	266	50	432	7.2	22.7
1	120	401.60	.08	.78	.78	60	59	6	264	51	413	6.0	24.8
NE 3	135	408.462	.13	1.27	1.27	60	60	7	269	52	419	6.2	25.2
2	150	417.24	.13	1.27	1.27	60	59	7	270	55	424	7.0	23.9
1	165		.09	.88	.88	60	58	6	250	55	417	6.3	24.3
END	180	433.646											

96.659 ✓

$\left(\sqrt{\Delta P_{avg}}\right)^2$ 1.071 ✓ $\frac{1.071}{\Delta H_{avg}}$ 58.3 ✓ Tm 423.5 ✓ 7.0 ✓ O_2 % 23.4 ✓ CO_2 %

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TRAVERSE SAMPLING DATA SHEET

Lab Number 1454

Client ASHGROVE
Location SEATTLE WA.
Sample Site MAIN STACK

Stack Diameter 156.0"
Date 03-29-97
Operators KPO
Run # R-7 Method M23

Stack Schematic Completed ✓
Sample Train Info Completed ✓
Pitot # P5K Side A
Thermocouple # T8K.
Meter Box ID JA6.
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # ____ Imp. Set B4

Start Time 14:55 hours
Stop Time 1806 hours
Barometric Press. 30.00 "Hg
Static Press. -.65 "H_2O
Production Rate SEE PROJECT MTG. - RAW MILL OFF.
Cyclonic Flow Check
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.003	
Leak Test Vacuum	15.0"	
Pitots, Leak Check	OK	
Gas Sampling System	O2/CO2	
Integrated Bag		
Probe Wash	Ace / H_2O / Other	
Alt. TC Cal.	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	506.2	- 377.1	=
#2	375.7	- 376.4	=
#3	371.7	- 370.4	=
#4		-	=
#5		-	=
SG	815.7	- 794.3	=
		Total Volume =	211.1 ✓

SAMPLING PARAMETERS

% Moisture 5%
Meter Temp.
Stack Temp.
ΔH@ 1.91
Y 0.976
Cp 0.84
Nozzle Diameter .356 inch
D1 ____ D2 ____ D3 ____
K Factor 10.002

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2 %
NW 3	0.0	433.856	.13	1.30	1.30	62	62	2.0	258	58	427	7.0	23.7
2	15.0	442.193	.11	1.10	1.10	62	62	3.0	260	49	429	5.8	25.3
1	30.0	450.470	.08	0.80	0.80	62	62	3.0	252	51	420	6.1	23.8
SW 3	45.0	457.717	.13	1.30	1.30	62	61	4.0	258	51	421	6.6	23.6
2	60.0	466.523	.12	1.20	1.20	62	61	4.0	252	49	434	6.5	23.6
1	75.0	475.090	.07	.70	.70	63	61	3.0	255	51	419	5.8	25.1
SE 3	90.0	481.774	.12	1.20	1.20	63	61	4.0	258	50	441	6.0	24.1
2	105.0	490.250	.11	1.10	1.10	65	63	4.0	257	50	437	5.8	25.3
1	120.0	498.410	.07	.70	.70	64	63	3.0	258	51	420	5.3	26.1
NE 3	135.0	505.290	.13	1.30	1.30	61	61	5.0	256	50	436	6.1	25.5
2	150.0	514.043	.14	1.40	1.40	62	60	5.0	251	52	435	6.1	25.5
1	165.0	523.762	.08	0.80	0.80	62	60	3.5	252	51	422	6.3	23.8
	180.0	530.199											
		96.343 ✓	$\left(\sqrt{\Delta P_{avg}}\right)^2$		1.075 ✓ ΔH_{avg}		62.0 ✓ Tm				428.3 ✓ Ts	6.1 ✓ O_2 %	24.6 ✓ CO_2 %

S300 AGCS2M003304

TRAVERSE SAMPLING DATA SHEET

Lab Number Field Blank

Client ASH GROVE
Location Seattle, WA
Sample Site Main Stack

Stack Diameter 46" 156"
Date 3-24-97
Operators JAO
Run # Blank Method M23

Stack Schematic Completed ____
Sample Train Info Completed ____
Pitot # ____ Side ____
Thermocouple # ____
Meter Box ID ____
Pressure Meas. Device
Mag. / Man. / S.R. I.D. ____
Filter # ____ Imp. Set B-1

Start Time ____ hours
Stop Time ____ hours
Barometric Press. ____ "Hg
Static Press. ____ "H_2O
Production Rate ____

Cyclonic Flow Check ____
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	<.02	
Leak Test Vacuum	15	
Pitots, Leak Check		
Gas Sampling System		
Integrated Bag		
Probe Wash	Ace / H_2O / Other	
Alt. TC Cal.	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	318.5	-	318.5	=	
#2	444.7	-	444.7	=	
#3	333.3	-	333.3	=	
#4		-		=	
#5		-		=	
SG	764.4	-	764.4	=	
			Total Volume =		

SAMPLING PARAMETERS

% Moisture ____
Meter Temp. ____
Stack Temp. ____
ΔH@ 1.91
Y 0.976
Cp .84
Nozzle Diameter .356 inch
D1 .356 D2 .356 D3 .356
K Factor ____

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %
NW 1	0	838.423										
2	15											
3	30											
SW 1	45											
2	60											
3	75											
SE 1	90											
2	105											
3	140											
NE 1	135											
2	150											
3	165											
END	180											

$\left(\sqrt{\Delta P_{avg}}\right)^2$ ____ ΔH_{avg} ____ Tm ____ O_2 % ____

AGCS2M003305 S300720

AMTEST AIR QUALITY, LLC

SAMPLE TRAIN INFORMATION

Fill out one sheet per site and per test type.

CLIENT: Ash Grove

LOCATION: _____

SITE: _____

TEST TEAM: _____ DATE(S) _____

RUN #'S: _____ TYPE: M23

Probe/Filter Temperature: _____ 248±25°F _____ 320°F _____ Other

Impinger Temperature: _____ <68°F _____ Other

THIMBLE: _____ yes ✓ no NOZZLE TYPE: ✓ quartz _____ steel

PROBE LINER: ✓ quartz _____ glass _____ steel _____ teflon

PROBE TYPE: ✓ regular _____ water-cooled

FRONT-HALF FILTER: ✓ yes _____ no SIZE (mm): _____ 90 _____ 110 ✓ 125
FRONT-HALF FILTER MEDIA: ✓ quartz fiber _____ glass fiber _____ teflon

SUPPORT: _____ steel _____ glass frit ✓ teflon GASKET: _____ silicon ✓ teflon

BACK-HALF FILTER: _____ yes ✓ no
BACK-HALF FILTER MEDIA: _____ quartz fiber _____ glass fiber _____ telfon _____ tared _____ untared
NOTE: Show the back-half filter location with an arrow on the table below.

CONTENTS	Initial Volume (mL)	Cleanup Solution Used	Bottle Type	Comments
Nozzle/Probe Rinse		ACE & DCM	250ml Amber	rinses 3x Ace & 3x DCM
Filter			500mL glass jar	
#1 Riser		ACE/DCM / Toluene	1L Amber / 500ml Amber	rinses: Ace x3
#2 Condenser		↓	↓	DCM x 3 → soak 5min Tol x 3 → soak 5min
#3 XAD-2 trap				wrap in foil Keep cold
#4 M.T. imp.	—	weigh & discard		
#5 DI H_2O imp.	100	↓		
#6 MT imp	—			
#7 Sg imp	—	↓		

IF THIS INFORMATION IS NOT ACCURATE FOR ALL RUNS, NOTE ALL EXCEPTIONS.

TRAVERSE SAMPLING DATA SHEET

Lab Number 1457

Client ASH GROVE
Location SEATTLE
Sample Site ~~[illegible] STACK~~ MAIN STACK
Stack Diameter ~~Hag~~ "156"
Date 3-25-97
Operators ERL
Run # 1 Method M101A

Stack Schematic Completed ____
Sample Train Info Completed ____
Pitot # P6E Side ____
Thermocouple # T6E
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D. ____
Filter # ____ Imp. Set R3&4

Start Time 0700 hours
Stop Time 0910 hours
Barometric Press. 30.05 "Hg
Static Press. -.50 "H_2O
Production Rate RAW MILL ON

Cyclonic Flow Check ____
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	1005	.007
Leak Test Vacuum	16"	15
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	Ace / H_2O / (Other)	
Alt. TC Cal. KMnO4 + HCl	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	761.7	-	575.6	=	
#2	680.3	-	648.0	=	
#3	683.1	-	677.3	=	
#4	542.0	-	539.7	=	
#5		-		=	
SG	810.4	-	791.6	=	
			Total Volume =		245.3 ✓

SAMPLING PARAMETERS

% Moisture .12
Meter Temp. 60
Stack Temp. 238
ΔH@ 2.060
Y .976
Cp .84
Nozzle Diameter .353 inch
D1 .353 D2 .353 D3 .352
K Factor 11.695

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
S&3	0	440.228	.19	2.22	2.22	58	57	6	256	49	227	10.3	18.3
2	10	447.74	.18	2.10	2.10	57	57	5	242	49	231	10.2	18.6
1	20	454.96	.12	1.42	1.42	58	57	4	250	49	227	10.4	18.2
S&3	30	460.911	.20	2.34	2.34	58	57	5½	234	56	227	10.3	18.2
2	40	468.46	.18	2.10	2.10	59	58	5	245	50	230	10.2	18.6
1	50	475.7	.13	1.52	1.52	60	58	4	247	52	2367	10.0	18.9
NE3	60	481.90	.21	2.45	2.45	61	58	6	257	55	229	10.1	19.3
2	70	—	.21	2.45	2.45	63	61	6	255	55	232	10.1	18.5
1	80	497.62	.12	1.40	1.40	64	62	4	250	56	228	10.2	18.4
NW3	96	503.657	.14	2.10	2.10	64	62	5	252	57	230	10.1	18.7
2	100	510.89	.19	2.22	2.22	63	62	6	248	57	231	9.8	19.8
1	110	518.28	.15	1.75	1.75	63	64	5	247	59	228	9.9	18.7
	120	524.997											

84.769 ✓

$\left(\sqrt{\Delta P_{avg}}\right)^2$

2.006 ✓ / ΔH_{avg}

60.0 ✓ / Tm

S300722 228.9 ✓ / Ts

10.1 ✓ / O_2 %

18.7 ✓ / CO_2 %

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TRAVERSE SAMPLING DATA SHEET

Lab Number 1458

Client ASH GROVE
Location SEATTLE
Sample Site MAIN STACK

Stack Diameter 156"
Date 3-25-97
Operators BRL
Run # 2 Method M 101A

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.006	.005
Leak Test Vacuum	16	13"
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	Ace / H_2O / (Other)	
Alt. TC Cal.	KMnO4 / HCl	TC Temp.
Thermometer ID		Therm Temp.

Stack Schematic Completed
Sample Train Info Completed
Pitot # P6E Side A
Thermocouple # T6E
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set Silica 1+2

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	795.6	-	796.8	=	
#2	678.3	-	645.5	=	
#3	655.7	-	657.4	=	
#4	493.7	-	494.7	=	-1.0
#5		-		=	
SG	878.0	-	851.3	=	

Total Volume = 255.6✓

Start Time 1045 hours
Stop Time 1327 hours
Barometric Press. 30.05 "Hg
Static Press. -.48 "H_2O
Production Rate RAW mill ON
Cyclonic Flow Check
(Attach sheet if applicable)

SAMPLING PARAMETERS

% Moisture 12
Meter Temp. 70
Stack Temp. 230
ΔH@ 2.060
Y .976
Cp .84
Nozzle Diameter .353 inch
D1 D2 D3
K Factor 11.91

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO
NW 3	0	525.519	.17	2.02	2.02	68	67	4	250	57	229	10.2	18.1
2	10	532.86	.17	2.02	2.02	69	68	3	246	57	229	10.3	18.0
1	20	540.20	.11	1.31	1.31	72	70	2	249	50	225	10.4	18.6
NE 3	30	546.030	.18	2.14	2.14	74	71	3	248	55	226	10.3	18.1
2	40	553.54	.17	2.04	2.04	77	76	3	255	63	228	10.1	18.6
1	50	560.66	.13	1.56	1.56	74	75	2½	250	51	226	10.9	16.6
SE 3	60	567.027	.19	2.28	2.28	74	75	3½	248	54	228	10.8	17.3
2	70	574.65	.16	1.92	1.92	74	74	3	245	58	229	9.9	19.2
1	80	581.64	.12	1.44	1.44	74	74	2½	250	65	224	10.2	18.3
SW 3	90	587.747	.19	2.28	2.28	73	73	4	259	61	224	10.2	17.7
2	100	595.42	.16	1.92	1.92	74	73	3	249	59	220	10.1	18.5
1	110	602.47	.11	1.32	1.32	73	73	2	249	62	218	10.3	18.6
END	120	608.262											

	82.743✓	$(\sqrt{\Delta P_{avg}})^2$	1.854✓ ΔH_{avg}	72.7✓ Tm	S300723	225.5✓ Ts	10.3✓ O_2 %	18.1✓ CO_2 %

AGCS2M003308

TRAVERSE SAMPLING DATA SHEET

Lab Number 1459

Client ASH GROVE
Location SEATTLE
Sample Site MAIN STACK

Stack Diameter 15"
Date 3-26-97
Operators FRL
Run # 3-4 Method 101A

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.005	.006
Leak Test Vacuum	15"	17"
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		

Probe Wash Ace / H_2O / (Other) KMnO4 HCl
Alt. TC Cal. TC Temp.
Thermometer ID Therm Temp.

Stack Schematic Completed
Sample Train Info Completed
Pitot # P6E Side A
Thermocouple # T6F
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set Baker

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	772.1	698.0	
#2	674.1	650.7	
#3	665.3	660.4	4.9
#4	495.6	495.1	0.5
#5			
SG	859.3	840.9	

Total Volume = 226.3✓

Start Time 13:13 hours
Stop Time ~~17:80~~ 1755 hours
Barometric Press. 29.80 "Hg
Static Press. -.46 "H_2O
Production Rate

Cyclonic Flow Check
(Attach sheet if applicable)

SAMPLING PARAMETERS

% Moisture 12
Meter Temp. 48
Stack Temp. 239
ΔH@ 2.060
Y .976
Cp .84
Nozzle Diameter .353 Inch
D1 D2 D3
K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	
SW 3	0	637.843	.18	2.12	2.12	65	64	3	250	54	251	9.8	19.2
2	10	645.22	.17	2.00	2.00	65	65	3	247	50	245	9.5	20.2
1	20	652.40	.12	1.41	1.41	65	64	2	248	49	241	9.6	19.9
SE 3	30	658.398	.17	2.00	2.00	65	65	3	249	53	239	9.6	20.1
2	40	665.52	.16	1.88	1.88	65	65	2½	251	47	238	9.7	20.8
1	50	672.47	.13	1.52	1.52	65	65	2½	250	50	233	9.8	19.8
NE 3	60	678.738	.17	2.00	2.00	64	64	3"	254	50	226	9.8	19.5
2	70	685.87	.14	1.65	1.65	63	63	2	250	49	225	10.0	19.3
1	80	692.34	.11	1.29	1.29	63	63	2	252	51	223	10.0	19.3
NW 3	90	698.102	.18	2.12	2.12	64	63	3	254	51	222	9.8	20.0
2	100	705.35	.17	2.00	2.00	62	62	3	250	48	223	9.7	19.7
1	110	712.52	.15	2.12	2.12	62	61	3	250	52	220	9.7	19.7
	120	719.869											
		82.026✓											

$\left(\sqrt{\Delta P_{avg}}\right)^2$ 1.843✓ ΔH_{avg} 63.8✓ Tm S300724 232.3✓ 9.7✓ O_2 % 19.8✓ CO_2 %

AGCS2M003309

TRAVERSE SAMPLING DATA SHEET

Lab Number 1460

Client ASH Group
Location Seattle
Sample Site MAIN STACK

Stack Diameter 156
Date 3-27-97
Operators BRL
Run # R-5 Method 101A

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.004	.005
Leak Test Vacuum	15"	22"
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		

Probe Wash Ace / H_2O / ~~Other~~
Alt. TC Cal. Kruloy etcl TC Temp.
Thermometer ID Therm Temp.

Stack Schematic Completed
Sample Train Info Completed
Pitot # P6E Side A
Thermocouple # T6E
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set S-102

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	709.4	596.3	
#2	674.8	655.8	
#3	666.7	663.7	
#4	548.9	548.7	
#5			
SG	879.1	868.6	

Total Volume = 145.9 ✓

Start Time 0700 hours
Stop Time 0923 hours
Barometric Press. 30.00 "Hg
Static Press. -.65 "H_2O
Production Rate Raw Mill OFF
Cyclonic Flow Check
(Attach sheet if applicable)

SAMPLING PARAMETERS

% Moisture .05
Meter Temp. 58
Stack Temp. 350
ΔH@ 2.060
Y .976
Cp .84
Nozzle Diameter .353 inch
D1 D2 D3
K Factor 11.199

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	CO_2
SW 3	0	720.248	.14	1.57	1.57	55	55	1	254	46	364	9.6	19.7
2	10	726.40	.16	1.79	1.79	55	55	1	250	45	368	9.3	21.4
1	20	732.99	.06	.66	.66	56	55	1	248	44	366	7.7	24.1
SE 3	30	737.178	.14	1.58	1.58	56	55	1	257	46	386	7.9	22.8
2	40	743.23	.14	1.50	1.50	57	55	1	253	44	392	8.6	21.6
1	50	749.37	.08	.86	.86	58	56	1	248	45	385	7.3	23.6
NE 3	60	754.011	.13	1.38	1.38	57	57	1	254	48	410	7.9	23.8
2	70	759.74	.14	1.49	1.49	58	57	1	249	47	414	7.4	23.7
1	80	766.—	.09	.96	.96	58	57	1	251	49	407	7.8	22.6
NW 3	90	770.746	.13	1.38	1.38	59	58	1	255	49	422	8.1	21.7
2	100	776.58	.13	1.38	1.38	59	58	1	254	47	422	7.8	22.5
1	110	782.40	.07	.74	.74	59	58	1	250	46	414	7.8	22.4
	120	786.785											

66.537 ✓ $(\sqrt{\Delta P_{avg}})^2$ 1.268 ✓ ΔH_{avg} 56.8 ✓ Tm S300725 395.8 ✓ Ts 8.1 ✓ O_2 % 22.5 ✓ CO_2 %

AGCS2M003310

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TRAVERSE SAMPLING DATA SHEET

Lab Number 1461

Client ASH GROVE
Location SEATTLE
Sample Site MAIN STACK

Stack Diameter 15c
Date 3-27-97
Operators EAL
Run # R-C Method 101A

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	~~100 18~~	.006
Leak Test Vacuum	18"	17"
Pitots, Leak Check	✓	
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	Ace / H_2O / ~~Other~~	
Alt. TC Cal.	KMnO3 / HCl TC Temp.	
Thermometer ID	Therm Temp.	

Stack Schematic Completed
Sample Train Info Completed
Pitot # PCE Side A
Thermocouple # TCE
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D.
Filter # Imp. Set ~~Bucket~~ Rel 1+2

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	713.4	-	602.7	=	
#2	667.5	-	648.7	=	
#3	675.2	-	670.8	=	
#4	536.0	-	536.0	=	
#5		-		=	
SG	820.0	-	809.5	=	

Total Volume = 144.4 ✓

Start Time 1045 hours
Stop Time 1259 hours
Barometric Press. 30.00 "Hg
Static Press. -.65 "H_2O
Production Rate RAW Mill OFF

Cyclonic Flow Check
(Attach sheet if applicable)

SAMPLING PARAMETERS

% Moisture .05
Meter Temp. 63
Stack Temp. ~~395~~ 486
ΔH@ 2.0Co
Y .976
Cp .84
Nozzle Diameter .353 inch
D1 D2 D3
K Factor 10.333

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	
SW 3	0	787.321	.13	1.38	1.38	61	61	1	255	51	426	7.3	23.1
2	10	793.08	.13	1.34	1.34	61	60	1	257	49	427	7.4	23.0
1	20	798.84	.09	.93	.93	61	60	1	250	48	418	7.3	23.1
SE 3	30	803.684	.15	1.55	1.55	61	61	1	255	49	425	7.4	22.8
2	40	809.64	.11	1.14	1.14	61	61	1	251	48	431	7.4	23.1
1	50	815.14	.09	.93	.93	62	61	1	252	49	423	7.4	23.3
NE 3	60	819.975	.14	1.45	1.45	62	61	1	257	52	427	7.6	22.5
2	70	825.92	.12	1.24	1.24	63	61	1	253	52	435	7.9	22.0
1	80	831.52	.10	1.03	1.03	63	62	1	253	53	419	7.9	21.4
NW 3	90	836.—	.15	1.55	1.55	63	64	1	259	54	427	7.0	23.2
2	100	842.68	.13	1.34	1.34	64	63	1	253	50	430	6.7	24.0
1	110	848.44	.07	.72	.72	64	63	1	252	51	409	6.1	25.0
	120	852.793											

65.472 ✓ $(\sqrt{\Delta P_{avg}})^2$ 1.213 ✓ ΔH_{avg} 61.8 ✓ Tm S300726 424.8 ✓ Ts 7.3 ✓ O_2 % 21.3 ✓ CO_2 %

AGCS2M003311

TRAVERSE SAMPLING DATA SHEET

Lab Number 1462

Client ASH GROVE
Location SEATTLE
Sample Site MAIN STACK

Stack Diameter 156"
Date 3-27-97
Operators EAL
Run # R-7 Method 101A

Stack Schematic Completed ____
Sample Train Info Completed ____
Pitot # P6E Side A
Thermocouple # TGE
Meter Box ID #10
Pressure Meas. Device
Mag. / Man. / S.R. I.D. ____
Filter # ____ Imp. Set R1324

Start Time 14:50 hours
Stop Time 17:06 hours
Barometric Press. 30.08 "Hg
Static Press. -.65 "H_2O
Production Rate RAW MILL OFF
Cyclonic Flow Check ____
(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.007	.006
Leak Test Vacuum	20"	22
Pitots, Leak Check	✓	✓
Gas Sampling System	✓	
Integrated Bag		
Probe Wash	Ace / H_2O / (Other)	
Alt. TC Cal. KM Nov Hcl	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams	Initial Wt. grams	Net Wt. grams
#1	686.4	577.7	=
#2	676.8	652.0	=
#3	682.4	677.3	=
#4	540.6	540.6	=
#5			=
SG	817.4	88.5	=
		Total Volume =	150.5✓

SAMPLING PARAMETERS

% Moisture .05
Meter Temp. 66
Stack Temp. 420
ΔH@ 2.060
Y .975
Cp .84
Nozzle Diameter .353 inch
D1 ____ D2 ____ D3 ____
K Factor 10.464

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	@O_2
SW 3	0	853.250	.13	1.36	1.36	64	63	3	254	53	431	7.0	23.5
2	10	859.—	.13	1.36	1.36	64	64	3	247	49	430	5.9	24.8
1	20	864.85	.09	.94	.94	64	64	2	257	50	425	6.9	23.7
SE 3	30	869.752	.14	1.47	1.47	65	64	3	247	51	426	6.6	24.1
2	40	875.74	.13	1.36	1.36	66	65	3	257	49	437	6.6	23.9
^ 1	50	881.62	.09	.94	.94	67	66	3	252	50	424	6.6	23.8
NE 3	60	886.516	.13	1.36	1.36	68	66	3	255	51	425	5.4	25.5
2	70	892.20	.13	1.36	1.36	68	67	3	244	52	442	5.4	25.6
1	80	898.03	.09	.94	.94	68	67	2	240	52	436	5.8	25.1
NW 3	90	902.931	.11	1.51	1.51	68	67	3	246	53	439	5.7	25.5
2	100	908.00	.11	1.51	1.51	67	66	4	251	52	436	5.4	25.5
1	110	915.11	.07	.73	.73	66	66	2	250	51	425	5.1	26.8
	120	919.498											
		66.248✓	$(\sqrt{\Delta P_{avg}})^2$	1.237✓ ΔH_{avg}		65.8✓ Tm					431.3✓ Ts	6.0✓ O_2 %	24.8✓

S300727
AGCS2M003312

TRAVERSE SAMPLING DATA SHEET

Lab Number

Client Ash Grove	Stack Schematic Completed	Start Time ___ hours
Location Seattle WA	Sample Train Info Completed	Stop Time ___ hours
Sample Site Main Stack	Pitot # ___ Side ___	Barometric Press. ___ "Hg
	Thermocouple #	Static Press. ___ "H_2O
Stack Diameter ~~168"~~ 156"	Meter Box ID	Production Rate
Date 3-24-97	Pressure Meas. Device	
Operators JAG-BRL	Mag. / Man. / S.R. I.D.	Cyclonic Flow Check
Run # Blank Method 101A	Filter # ___ Imp. Set ___	(Attach sheet if applicable)

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	0.02	
Leak Test Vacuum	15	
Pitots, Leak Check		
Gas Sampling System		
Integrated Bag		
Probe Wash	Ace / H_2O / Other	
Alt. TC Cal.	TC Temp.	
Thermometer ID	Therm Temp.	

Imp	Final Wt. grams		Initial Wt. grams		Net Wt. grams
#1	599.6	-	599.6	=	0.0
#2	670.4	-	670.4	=	0.0
#3	647.2	-	647.2	=	0.0
#4	536.4	-	536.4	=	0.0
#5		-		=	
SG	809.5	-	809.5	=	0.0
			Total Volume	=	

SAMPLING PARAMETERS

% Moisture

Meter Temp.

Stack Temp.

ΔH@

Y

Cp

Nozzle Diameter ___ inch

D1 ___ D2 ___ D3 ___

K Factor

Sample Point	Elapsed Time min	Dry Gas Meter Reading cu. ft.	Pitot Reading ΔP "H_2O	Orifice Setting ΔH "H_2O Ideal	Orifice Setting ΔH "H_2O Actual	Gas Meter Temp Deg. F In	Gas Meter Temp Deg. F Out	Pump Vac. Gauge "Hg	Filter Box Temp. Deg. F	Imp. Exit Temp. Deg. F	Stack Temp. Deg. F	O_2 %	

$(\sqrt{\Delta P_{avg}})^2$ ΔH_{avg} Tm O_2 %

AMTEST AIR QUALITY, LLC

SAMPLE TRAIN INFORMATION

Fill out one sheet per site and per test type.

CLIENT: Ash Grove

LOCATION: Seattle WA

SITE: M&N Stack

TEST TEAM: JAG ERL DR DATE(S) _____

RUN #'S: 1-7 TYPE: Method 101A

Probe/Filter Temperature: ✓ 248±25°F _____320°F _____Other

Impinger Temperature: ✓ <68°F _____Other

THIMBLE: _____yes ✓ no NOZZLE TYPE: ✓ quartz _____steel

PROBE LINER: ✓ quartz _____glass _____steel _____teflon

PROBE TYPE: ✓ regular _____water-cooled

FRONT-HALF FILTER: _____yes ✓ no SIZE (mm): _____90 _____110 _____125
FRONT-HALF FILTER MEDIA: _____quartz fiber _____glass fiber _____teflon

SUPPORT: _____steel _____glass frit _____teflon GASKET: _____silicon _____teflon

BACK-HALF FILTER: ____yes ✓ no
BACK-HALF FILTER MEDIA: ____quartz fiber ____glass fiber ____telfon ____tared ____untared
NOTE: Show the back-half filter location with an arrow on the table below.

CONTENTS	Initial Volume (mL)	Cleanup Solution Used	Bottle Type	Comments
Nozzle/Probe Rinse		KMnO4 / * HCl	Glass 1 L Amber	* Can use small amt. of HCl if probe & nozzle are stained brown. Combine both KMnO4 & HCl rinses
Filter				
#1 4% KMnO4	50	KMnO4	Add to probe & nozzle rinse container	
#2 4% KMnO4	100	↓	↓	
#3 4% KMnO4	100	↓	↓	
#4 MT		↓	↓	
#5 Sg				
#6				
#7				

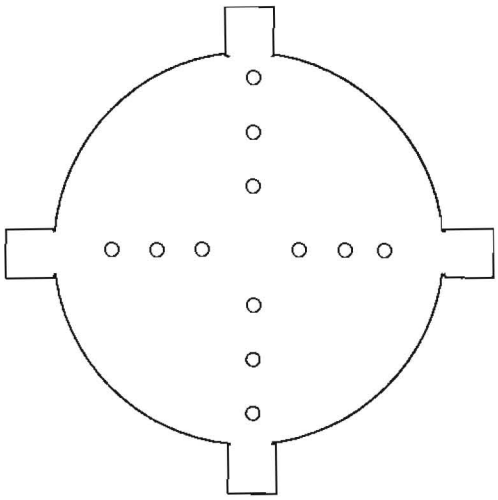
IF THIS INFORMATION IS NOT ACCURATE FOR ALL RUNS, NOTE ALL EXCEPTIONS.

APPENDIX E

Miscellaneous Supporting Information

CROSS SECTIONAL AREA

Traverse Point	Distance (Inches)
1	6.86
2	22.78
3	46.18



STACK DIMENSIONS

156-inch diameter stack

4 ports at 90 degrees

A = > 2 stack diameters downstream

B = > 8 stack diameters upstream

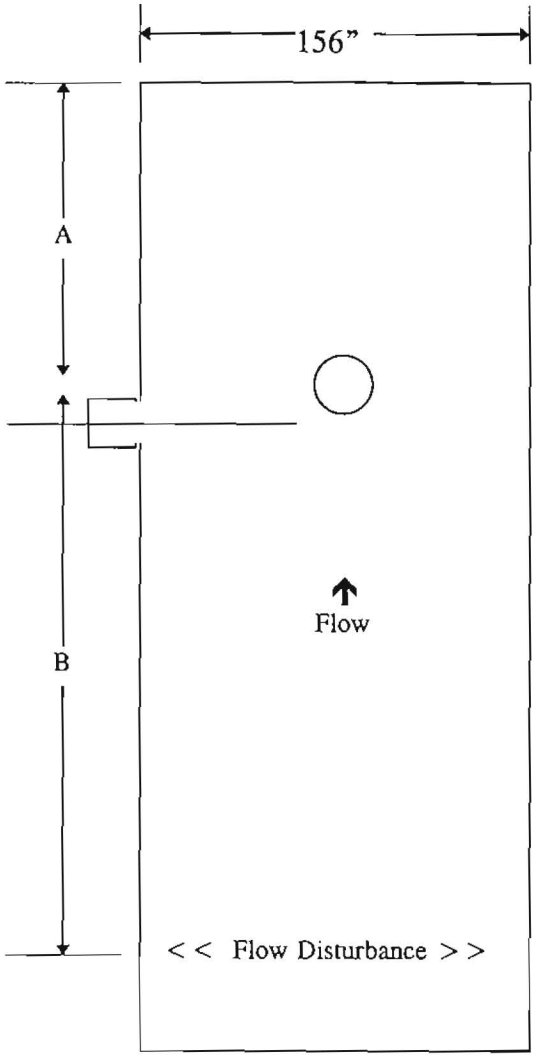


Figure 1: Location of sampling ports and traverse points. Cement Kiln Main Stack

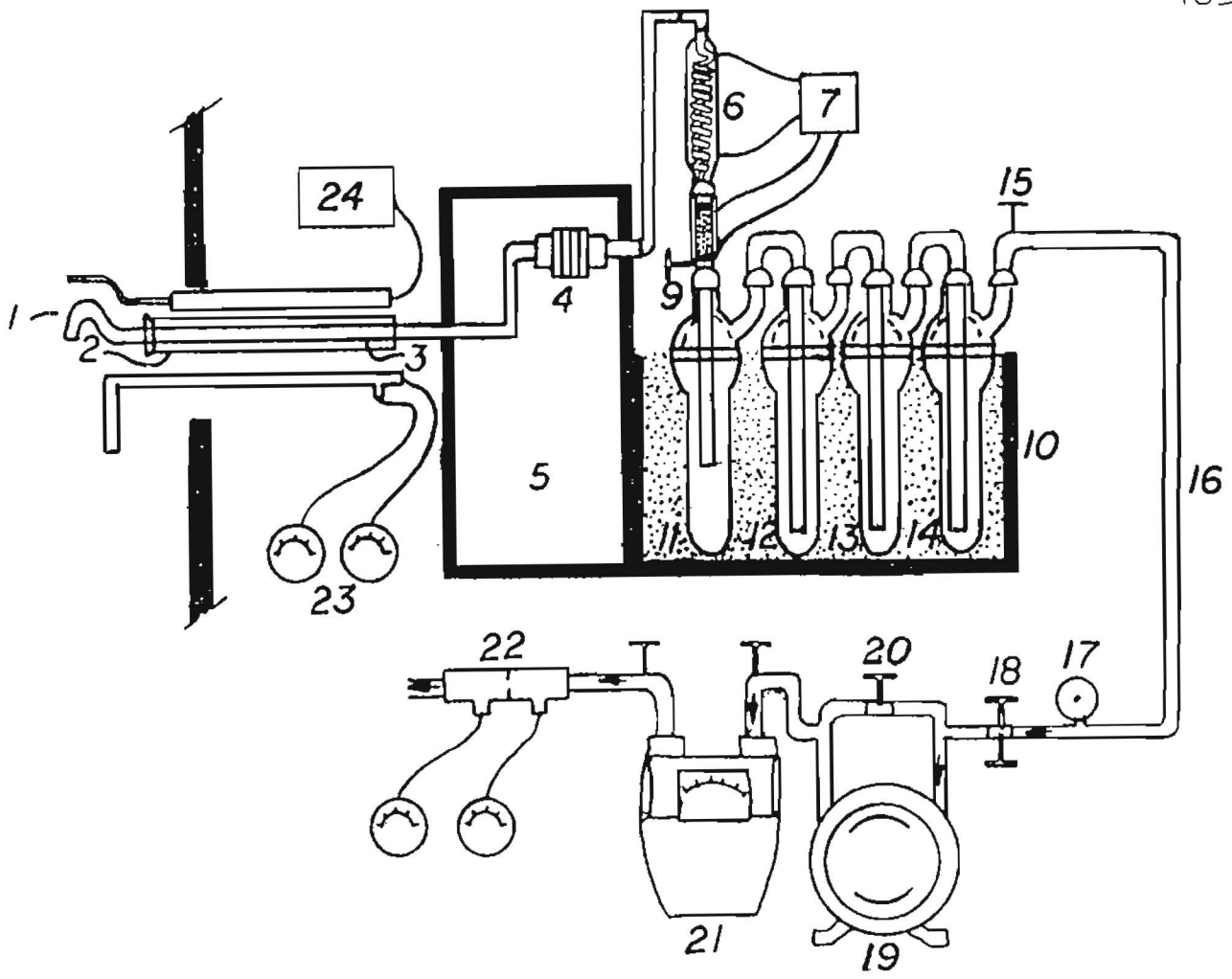


Figure 2. Semi-Volatile Organic Sample Train.

1. Sampling nozzle
2. Sampling probe sheath
3. Heated sample probe liner
4. Out of stack filter assembly
5. Heated filter compartment maintained at 248°F ± 25°F (or temperature specified in 40 CFR subpart)
6. Ice water cooled coil condenser
7. Recirculating pump
8. Water cooled sorbent module containing XAD-2 resin
9. Sorbent module exit gas temperature sensor
10. Impinger case - contains ice during sampling
11. First impinger w/ short stem - empty (knock-out)
12. Modified Greenburg-Smith impinger containing 100 ml H_2O
13. Third impinger - empty
14. Fourth impinger containing indicating silica gel desiccant
15. Impinger exit gas temperature sensor
16. Umbilical cord - vacuum line
17. Vacuum gauge
18. Fine and coarse adjustment valves
19. Leak free pump
20. By-pass valve
21. Dry gas meter with inlet and outlet temperature sensors
22. Orifice meter with magnehelic gauges
23. P or S-type pitot tube with magnehelic gauges
24. Fluke multi-channel digital thermocouple indicator

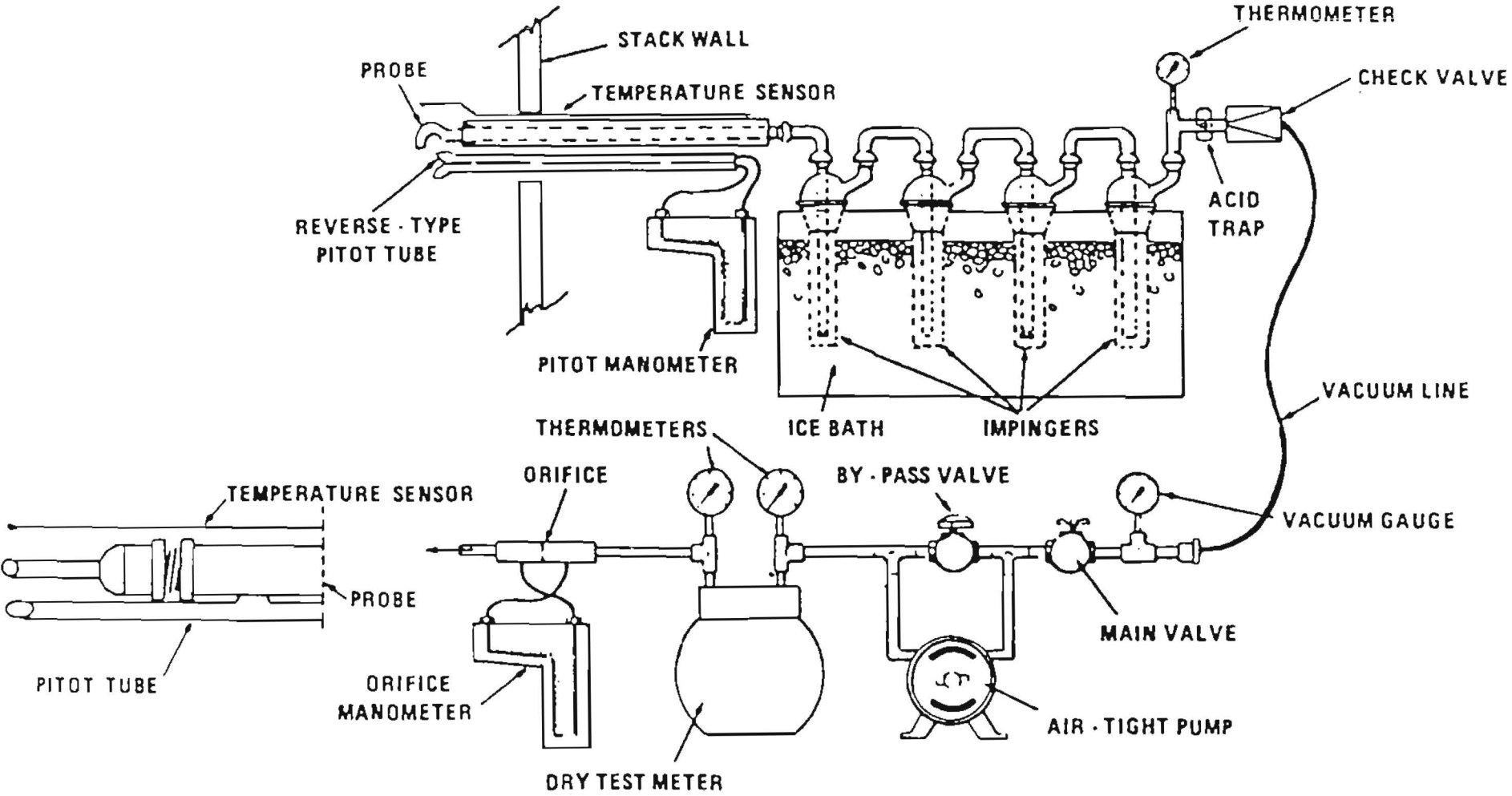


Figure 3, EPA Method 101A (Mercury) Sampling Train

METHOD 1 - LOCATION OF TRAVERSE POINTS

Circular Stacks

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.7
3	29.5
4	70 5
5	85 3
6	95 6

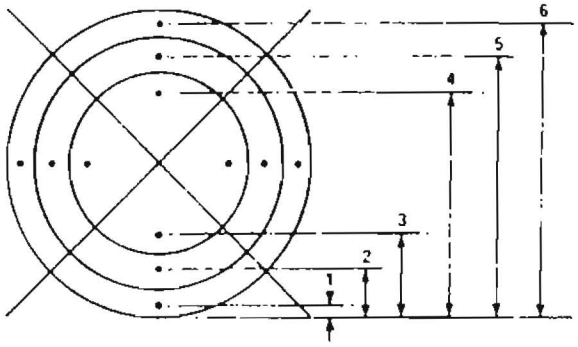


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10 5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.8	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9

Rectangular Stacks

For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{(L+W)}$$

where L = length and W = width.

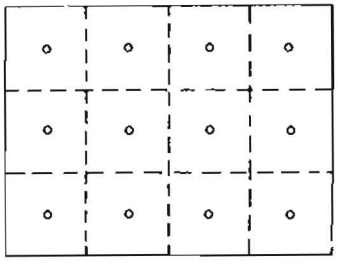


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

METHOD 1 - MINIMUM NUMBER OF TRAVERSE POINTS

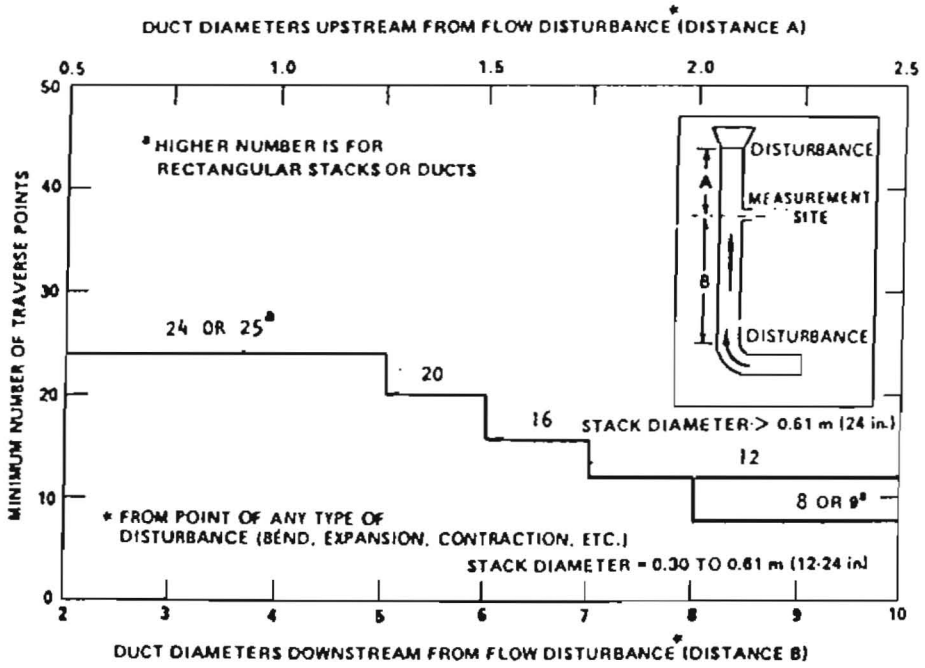


Figure 1-1. Minimum number of traverse points for particulate traverses.

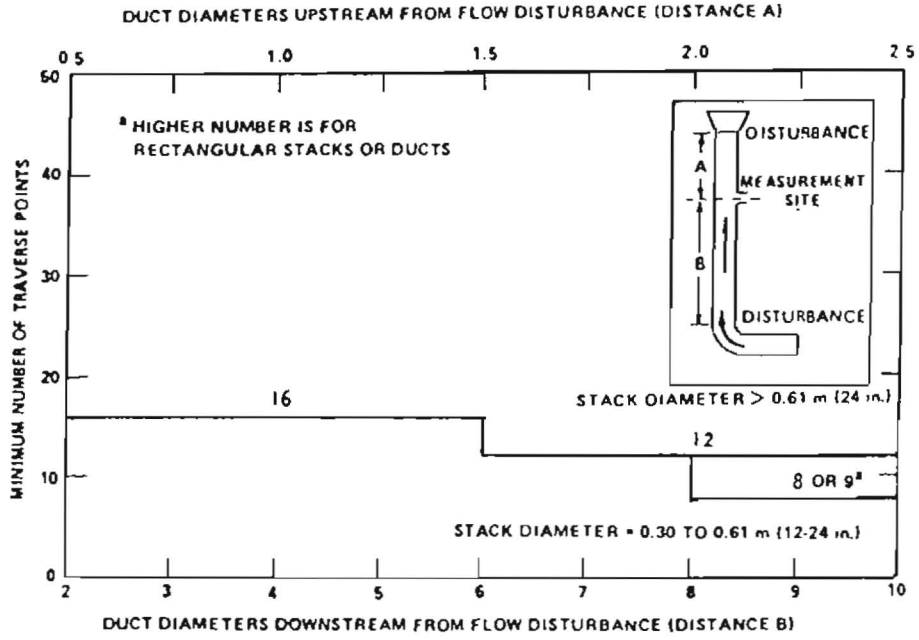


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

METHOD 2 - STACK GAS VELOCITY AND VOLUMETRIC FLOW CALCULATIONS

5.1 Nomenclature.

A = Cross-sectional area of stack, m^2 (ft^2).
B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.
C_p = Pitot tube coefficient, dimensionless.
K_p = Pitot tube constant,

$$34.97 \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system and

$$85.49 \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).
M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d(1 - B_{ws}) + 18.0\ B_{ws} \qquad \text{Eq. 2-5}$$

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).
P_g = Stack static pressure, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).

$$= P_{bar} + P_g \qquad \text{Eq. 2-6}$$

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).
t_s = Stack temperature, °C (°F).
T_s = Absolute stack temperature, °K, (°R).

$$= 273 + t_s \text{ for metric.} \qquad \text{Eq. 2-7}$$

$$= 460 + t_s \text{ for English.} \qquad \text{Eq. 2-8}$$

T_{std} = Standard absolute temperature, 293 °K (528° R).
v_s = Average stack gas velocity, m/sec (ft/sec).
Δ_p = Velocity head of stack gas, mm H_2O (in. H_2O).
3,600 = Conversion factor, sec/hr.
18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average Stack Gas Velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}} \qquad \text{Equation 2-9}$$

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd} = 3{,}600(1 - B_{ws}) v_s A \left(\frac{T_{std}}{T_{s\ (avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \qquad \text{Eq. 2-10}$$

METHOD 3 - MOLECULAR WEIGHT AND EXCESS AIR CALCULATIONS

6.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (lb/lb-mole).
%EA = Percent excess air.
$\%CO_2$ = Percent CO_2 by volume (dry basis).
$\%O_2$ = Percent O_2 by volume (dry basis).
%CO = Percent CO by volume (dry basis).
$\%N_2$ = Percent N_2 by volume (dry basis).
0.264 = Ratio of O_2 to N_2 in air, v/v.
0.280 = Molecular weight of N_2 or CO, divided by 100.
0.320 = Molecular weight of O_2 divided by 100.
0.440 = Molecular weight of CO_2 divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O_2, CO, and N_2 (obtained from Section 4.1.3 or 4.2.4) into Equation 3-1.

$$\%\ EA = \frac{\%O_2 - 0.5\%\ CO}{0.264\%\ N_2(\%O_2 - 0.5\%\ CO)} \times 100 \qquad \text{Eq. 3-1}$$

NOTE: The equation above assumes that ambient air is used as the source of O_2 and that the fuel does not contain appreciable amounts of N_2 (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N_2 are present (coal, oil, and natural gas do not contain appreciable amounts of N_2) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO) \qquad \text{Eq. 3-2}$$

METHOD 4 - STACK GAS MOISTURE CALCULATIONS

2.3.1 Nomenclature.

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg) (m^3)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft^3)/(lb-mole) (°R) for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293° K (528°R).

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

ΔV_m = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed corrected to standard conditions, scm (scf).

$V_{wsg(std)}$ = Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).

V_f = Final volume of condenser water, ml.

V_i = Initial volume, if any, of condenser water, ml.

W_f = Final weight of silica gel or silica gel plus impinger, g.

W_i = Initial weight of silica gel or silica gel plus impinger, g.

Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of Water Vapor Condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w}$$

$$= K_1 (V_f - V_i)$$

Eq. 4-1

K_1 = 0.001333 m^3/ml for metric units
= 0.04707 ft^3/ml for English units

2.3.3 Volume of Water Vapor Collected in Silica Gel.

$$V_{wsg(std)} = \frac{(W_f - W_i) R T_{std}}{P_{std} M_w}$$

$$= K_2 (W_f - W_i)$$

Eq. 4-2

Where:

K_2 = 0.001335 m^3/g for metric units
= 0.04715 ft^3/g for English units

2.3.4 Sample Gas Volume.

$$V_{m(std)} = V_m Y \frac{(P_m)(T_{std})}{(P_{std})(T_m)}$$

$$= K_3 Y \frac{V_m P_m}{T_m}$$

Eq. 4-3

Where:

K_3 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE: If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Eq. 4-4

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

NOMENCLATURE
METHOD 5 CALCULATIONS

Vm_{std} = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

Y = Dry gas meter calibration factor

P_b = Barometric pressure at the sampling site, mm Hg (in. Hg)

H = Average pressure differential across the orifice meter, mm H_2O (in. H_2O)

T_m = Absolute average dry gas meter temperature, ° K (° R)

dscm = Dry standard cubic meters

dscf = Dry standard cubic feet

W_a = Weight of residue in acetone wash

M_a = Mass of residue of acetone after evaporation, mg

C_a = Acetone blank residue concentration, mg/g

V_a = Volume of acetone blank

V_{aw} = Volume of acetone used in wash, ml

M_n = Total amount of particulate matter collected, mg

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, mg/dscm (gr/dscf)

gr/dscf = grains per dry standard cubic foot

Vw_{std} = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf)

B_{ws} = Water vapor in the gas stream, proportion by volume

M_d = Molecular weight of stack gas, g/g-mole on dry basis

M_s = Molecular weight of stack gas, g/g-mole on wet basis

V_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec)

C_p = Pitot tube coefficient, dimensionless

Δ_p = Velocity head of stack gas, mm H_2O (in. H_2O)

P_s = Absolute stack gas pressure, mm Hg (in. Hg)

NOMENCLATURE (continued)
METHOD 5 CALCULATIONS

Q_{std} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr)

dscf/min = dry standard cubic feet per minute (also identified as dcfm or scfm)

acfm = actual cubic feet per minute

I = Percent of isokinetic sampling

A_n = Cross-sectional area of nozzle, m^2 (ft^2)

EMISSION MEASUREMENT TECHNICAL INFORMATION CENTER
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Alternative Method 5 Post-Test Calibration

INTRODUCTION AND BACKGROUND

EPA Method 5 requires the calibration of the metering system after each field use. Because the post-test calibration requires the use of a spirometer or wet test meter, the calibration is often conducted in the laboratory. However, a field calibration procedure is highly desirable for two reasons: (1) it eliminates questions about the possibility of the damage to the metering system occurring during transport and (2) it eliminates travel costs for a retest if the metering system fails the post-test calibration.

The alternative post-test calibration procedure described below is based on the principles of the optional pretest orifice meter coefficient check in Section 4.4.1 of Method 5. Since the orifice meter coefficient check will not detect leakages between the inlet of the metering system and the dry gas meter, the alternative procedure includes two additional steps: (1) a leak check from either the inlet of the sampling train or the inlet of the metering system and (2) a leak check of that portion of the sampling train from the pump to the orifice meter.

PROCEDURE

The alternative to the post-test calibration in Section 5.3.2 of Method 5 is as follows:

After each test run, do the following:

1. Ensure that the metering system has passed the post-test leak-check. If not, conduct a leak-check of the metering system from its inlet.

2. Conduct the leak-check of that portion of the train from the pump to the orifice meter as described in Section 5.6 of Method 5.

3. Calculate Y_{qa} for each test run using the following equation:

$$Y_{qa} = \frac{\theta}{V_m}\sqrt{\frac{0.0319\,T_m}{\Delta H_@\left(P_b + \Delta\frac{H_{avg}}{13.6}\right)}\frac{29}{M_d}}\;\left(\sqrt{\Delta H}\right)_{avg}$$

where:

Y_{qa} = dry gas meter calibration check value, dimensionless.
θ = total run time, min.
V_m = total sample volume measured by dry gas meter, dcf.
T_m = absolute average dry gas meter temp., oR.
P_b = barometric pressure, in. Hg.
0.0319 = $(29.92/528)(0.75)^2$ (in. Hg/o/R) cfm^2.

ΔH_{avg} = average orifice meter differential, in. H_2O.
$\Delta H@$ = orifice meter calibration coefficient, in. H_2O.
M_d = dry molecular weight of stack gas, lb/lb-mole.
29 = dry molecular weight of air, lb/lb-mole.
13.6 = specific gravity of mercury.

After each test run series, do the following:

4. Average the three or more Y_{qa}'s obtained from the test run series and compare this average Y_{qa} with the dry gas meter calibration factor, Y. The average Y_{qa} must be within 5 percent of Y.

5. If the average Y_{qa} does not meet the $\pm$5 percent criterion, recalibrate the meter over the full range of orifice settings, as detailed in Section 5.3.1 of Method 5. Then follow the procedure in Section 5.3.3 of Method 5.

REFERENCE

Roger T. Shigehara, P.G. Royals, and E.W. Steward, "Alternative Method 5 Post-Test Calibration", Entropy, Inc, contained in the EMTIC TSAR Library.

AMTEST
AIR QUALITY, LLC

DRY GAS METER CALIBRATION
Am Test-Air Quality, LLC

FILE NAME: MB#10/GRERL397
METER BOX #: #10 Green ERL Meter Box
CALIBRATION DATE: 3-6-97
METHOD OF CALIB.: STANDARD DRY GAS METER (Method 5 Section 7.1)

	Meter Box Dry Gas Meter Readings						Standard Dry Gas Meter Readings						
TOTAL TIME (min)	DELTA H ("H2O)	METER VOL Vi (cu. ft.)	METER VOL Vf (cu. ft.)	TEMP IN (deg F)	TEMP OUT (deg F)	BARO. PRES. ("Hg)	STD DGM Vi (cu. ft.)	STD DGM Vf (cu. ft.)	ST.DGM TEMP IN (deg F)	ST.DGM TEMP OUT (deg F)	ST.DGM Yds FACTOR	Y FACTOR	DELTA H@
13.0	0.5	133.397	138.447	65.0	64.0	29.55	644.136	649.011	63.0	63.0	1.006	0.973	1.967
13.5	1.0	138.562	145.784	66.0	64.0	29.55	649.118	656.108	64.0	63.0	1.006	0.974	2.068
13.0	1.5	146.012	154.431	67.0	64.0	29.55	656.320	664.503	65.0	64.0	1.006	0.976	2.107
12.0	2.0	197.499	206.602	72.0	67.0	29.55	706.420	715.246	67.0	67.0	1.006	0.975	2.065
13.0	2.5	167.178	178.146	70.0	66.0	29.55	676.900	687.560	66.0	66.0	1.006	0.975	2.073
8.5	3.0	178.439	186.293	71.0	67.0	29.55	687.844	695.491	67.0	66.0	1.006	0.977	2.067
7.5	3.5	186.605	194.062	72.0	67.0	29.55	695.796	703.073	67.0	66.0	1.006	0.979	2.073
										AVERAGE		**0.976**	**2.060**

S300742

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AGCS2M003327

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Thermocouple I.D. INlet outlet

#10 IN

#10 out

Thermocouple Calibration Data Sheet

Date 3-10-97

Initials EM

Ambient Temperature 68 °F

Barometric Pressure 29.75 "Hg

T.C. Indicator #10

Reference I.D.

	Reference Temperature* °F	Thermocouple Temperature* °F	Temperature Difference** °F	Temperature Difference** %
Ice Bath	32	34/34	2/0	.4%/0
	32	34/34	2/0	.4%/0
	32	34/34	2/0	/0
Boiling Water	212	212/212	0/0	0/0
	212	212/212	0/0	0/0
	212	212/212	0/0	0/0
~~Hot Oil~~ Amb	68	68/68	0/0	0/0
	68	68/69	0/1	0/.2%
	68	68/68	0/0	0/0

*Readings taken at one minute intervals

** (ref. temp.°F + 460) - (test T.C. temp.°F + 460)/(ref.temp.°F + 460) x 100 < 1.5

EM

PRESSURE SENSOR CALIBRATION DATA FORM

Date 3-4-97 Control Box # WALL MANOMETER

Ambient Temperature 59 °F Barometric Pressure 27.85 in Hg

MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	%
#10-0-2 NEW 3-4-97	-1.65	-1.65	0	0
	-.96	-.97	.01	1%
	-.50	-.50	0	0
	+.50	+.50	0	0
	+1.10	+1.06	.04	3.6%
	1.75	1.75	0	0
#10-0-1	+.88	+.85	.03	3.4%
	+.53	+.53	0	0
	+.17	+.17	0	0
	-.83	-.80	.03	3.6%
	-.57	-.55	.02	3.5%
	-.18	-.18	0	0

$$\frac{(\text{ref pres. "H}_2O - \text{test pres. "H}_2O))}{(\text{ref pres. "H}_2O)} * 100 \leq 5\%$$

EM

PRESSURE SENSOR CALIBRATION DATA FORM

Date 3-4-97 Control Box # WALL MANOMETER

Ambient Temperature 59 °F Barometric Pressure 29.85 in Hg

MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	%
#10 0-6 NEW 3-4-97	+ 4.8	+ 4.8	0	0
	+ 3.0	+ 3.0	0	0
	+ 1.0	+ 1.0	0	0
	- 4.6	-4.6	0	0
	-3.0	-3.0	0	0
	- 1.0	-1.0	0	0
#10 0-4 NEW 3-4-97	3.5	3.5	0	0
	2.0	2.0	0	0
	0.5	0.5	0	0
	- 3.45	-3.5	.05	1.4%
	-2.00	-2.00	0	0
	-.50	-.50	0	0

$$\frac{(\text{ref pres. "H}_2O - \text{test pres. "H}_2O))}{(\text{ref pres. "H}_2O)} * 100 \leq 5\%$$

EMJ

AMTEST
AIR QUALITY, LLC

DRY GAS METER CALIBRATION
Am Test-Air Quality, LLC

FILE NAME: #1JAG397
METER BOX #: #1 Orange JAG
CALIBRATION DATE: 3/10/97
METHOD OF CALIB.: STANDARD DRY GAS METER (Method 5 Section 7.1)

	Meter Box Dry Gas Meter Readings						Standard Dry Gas Meter Readings						
TOTAL TIME (min)	DELTA H ("H2O)	METER VOL Vi (cu. ft.)	METER VOL Vf (cu. ft.)	TEMP IN (deg F)	TEMP OUT (deg F)	BARO. PRES. ("Hg)	STD DGM Vi (cu. ft.)	STD DGM Vf (cu. ft.)	ST.DGM TEMP IN (deg F)	ST.DGM TEMP OUT (deg F)	ST.DGM Yds FACTOR	Y FACTOR	DELTA H@
15.0	0.5	800.365	806.205	66.0	65.0	29.74	720.700	726.420	65.0	65.0	1.006	0.985	1.901
10.0	1.0	806.205	811.802	67.0	66.0	29.74	726.420	731.840	65.0	65.0	1.006	0.975	1.879
8.0	1.5	811.902	817.460	68.0	66.0	29.74	731.840	737.215	65.0	65.0	1.006	0.973	1.834
8.0	2.0	817.460	823.821	69.0	66.0	29.74	737.215	743.382	66.0	65.0	1.006	0.974	1.861
9.0	2.5	823.821	831.550	69.0	67.0	29.74	743.382	750.900	66.0	65.0	1.006	0.977	1.977
7.0	3.0	831.550	838.090	69.0	67.0	29.74	750.900	757.252	66.0	65.0	1.006	0.975	2.011
										AVERAGE		**0.976**	**1.910**

S300746

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AGCS2M003331

Thermocouple I.D. DCM 1A

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Thermocouple Calibration Data Sheet

Date 3-10-97
Initials ACP
Ambient Temperature 65 °F
Barometric Pressure 29.74 "Hg

T.C. Indicator JAC OR RONDOUT
Reference I.D. MERCURY IN GLASS

JAC OR BOX

	Reference Temperature* °F	Thermocouple Temperature* °F	Temperature Difference** °F	Temperature Difference** %
Ice Bath	32	32	—	—
	32	32	—	—
	32	32	—	—
Boiling Water	211	212	1	0.2
	211	212	1	0.2
	211	211	—	—
~~Hot Oil~~ AMBIENT T	65	64	1	0.2
	65	65	—	—
	65	64	1	0.2

*Readings taken at one minute intervals

** (ref. temp.°F + 460) - (test T.C. temp.°F + 460)/(ref.temp.°F + 460) x 100 < 1.5

Thermocouple I.D. DGM out

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Thermocouple Calibration Data Sheet

Date 3-10-97
Initials ACP
Ambient Temperature 65 °F
Barometric Pressure 29.74 "Hg

T.C. Indicator JAG OR Readout
Reference I.D. Mercury in Glass

JAG OR Box

	Reference Temperature*	Thermocouple Temperature*	Temperature Difference**	
	°F	°F	°F	%
Ice Bath	32	32	—	—
	32	32	—	—
	32	33	~~0.2~~ 1.0 AMP	0.2
Boiling Water	211	211	—	—
	211	211	—	—
	211	211	—	—
~~Hot Oil~~ AMBIENT	65	64	1	0.2
	65	64	1	0.2
	65	64	1	0.2

*Readings taken at one minute intervals

** (ref. temp.°F + 460) - (test T.C. temp.°F + 460)/(ref.temp.°F + 460) x 100 < 1.5

PRESSURE SENSOR CALIBRATION DATA FORM

Date 3-10-97 Control Box # WALL MANOMETER

Ambient Temperature 65 °F Barometric Pressure 29.74 in Hg

JAC-ORANGE M5 Box

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
LOW	0-1	0.80	0.80	—	—
		0.60	0.60	—	—
		0.40	0.40	—	—
		0.20	0.19	0.01	0.5
HIGH	0-1	0.80	0.80	—	—
		0.60	0.60	—	—
		0.40	0.40	—	—
		0.20	0.19	0.01	0.5
LOW	0-.25	0.20	0.20	—	—
		0.05	0.15	—	—
		0.10	0.10	—	—
		0.05	0.05	—	—
HIGH	0-.25	0.20	0.20	—	—
		0.15	0.15	—	—
		0.10	0.10	—	—
		0.05	0.05	—	—

$$\frac{(\text{ref pres. "H}_2O - \text{test pres. "H}_2O)}{(\text{ref pres. "H}_2O)} * 100 \leq 5\%$$

PRESSURE SENSOR CALIBRATION DATA FORM

Date 3-10-97 Control Box # WALL MANOMETER

Ambient Temperature 65 °F Barometric Pressure 29.74 in Hg

TAG ORANGE MS BOX

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
LOW	0-4	3.20	3.20	—	—
		2.40	2.30	0.1	4.2
		1.65	1.60	0.05	3.0
		0.80	0.80	—	—
HIGH	0-4	3.20	3.20	—	—
		2.40	2.30	0.1	4.2
		1.65	1.60	0.05	3.0
		0.80	0.80	—	—
LOW	0-2	1.60	1.60	—	—
		1.20	1.20	—	—
		0.80	0.80	—	—
		0.40	0.40	—	—
HIGH	0-2	1.60	1.60	—	—
		1.20	1.20	—	—
		0.80	0.80	—	—
		0.40	0.40	—	—

$$\frac{(\text{ref pres. "}H_2O - \text{test pres. "}H_2O)}{(\text{ref pres. "}H_2O)} * 100 \leq 5\%$$

PRESSURE SENSOR CALIBRATION DATA FORM

Date 3-10-97 Control Box # WALL MANOMETER

Ambient Temperature 65 °F Barometric Pressure 29.74 in Hg

SAC-ORANGE M5 Box

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
LOW	0-15	10.0	10.0	—	—
		7.0	7.0	—	—
		4.0	4.0	—	—
		2.0	2.0	—	—
HIGH	0-15	10.0	10.0	—	—
		7.0	7.0	—	—
		4.0	4.0	—	—
		2.0	2.0	—	—
LOW	0-6	4.80	4.80	—	—
		3.80	3.70	0.1	2.8
		2.40	2.40	—	—
		1.20	1.20	—	—
HIGH	0-6	4.80	4.80	—	—
		3.60	3.70	0.1	2.8
		2.40	2.40	—	—
		1.20	1.20	—	—

$$\frac{(\text{ref pres. "H}_2O - \text{test pres. "H}_2O))}{(\text{ref pres. "H}_2O)} * 100 \leq 5\%$$

AMTEST
AIR QUALITY, LLC

Standard Dry Gas Meter Calibration

Am Test-Air Quality Meter Identification: Standard Dry Gas Meter #2
Calibration Meter/Serial Number: Equimeter #2299007
Calibrated by Homer Dulin Co. on 1/9/97
Calibrated against spirometer
File: GW4:slw:\sharon's\calfile\stdm#297;1.006

Indicated Volume (cfm)	Actual Volume (cfm)	Net Yds Factor
1.214	1.217	1.002
1.211	1.219	1.007
1.221	1.224	1.002
0.980	0.988	1.008
0.967	0.974	1.007
0.972	0.984	1.012
0.801	0.799	0.998
0.792	0.797	1.006
0.800	0.808	1.010
0.606	0.611	1.008
0.627	0.628	1.002
0.599	0.601	1.003
0.443	0.446	1.007
0.448	0.456	1.018
0.438	0.439	1.002
	Net Average Yds Factor:	1.006

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HOMER R. DULIN CO.

729 EAST WILLOW STREET
LONG BEACH, CALIFORNIA 90806
(310) 424-8533 (213) 636-4096 FAX (310) 426-7707

CERT. NO. 1-256-7

CALIBRATION CERTIFICATION

SUBMITTED BY: AM TEST AIR QUALITY

FLOWMETER SERIAL No.: LM #9

MANUFACTURER: EQUIPMETER: MFG. SERIAL NO: 2299007

MODEL: CL-250

TUBE No: . Float No: .

Remarks: CALIBRATED IN CFM AIR @ 14.7 PSIA & 70 DEG F.

Accuracy: SEE DATA

INDICATED		ACTUAL	
CFM		CFM	
1.214		1.217	
1.211		1.219	
1.221		1.224	
0.980		0.988	
0.967		0.974	
0.972		0.984	
0.801		0.799	
0.792		0.797	
0.800		0.808	
0.606		0.611	
0.627		0.628	
0.599		0.601	
0.443		0.446	
0.448		0.456	
0.438		0.439	

Flowmeter Certified with HOMER R. DULIN CO.

Equipment No. 12400 Accuracy 0.2% Calib. Due 5-21-98

NIST Cert. No. 821/256550-96 Procedure No: 101G

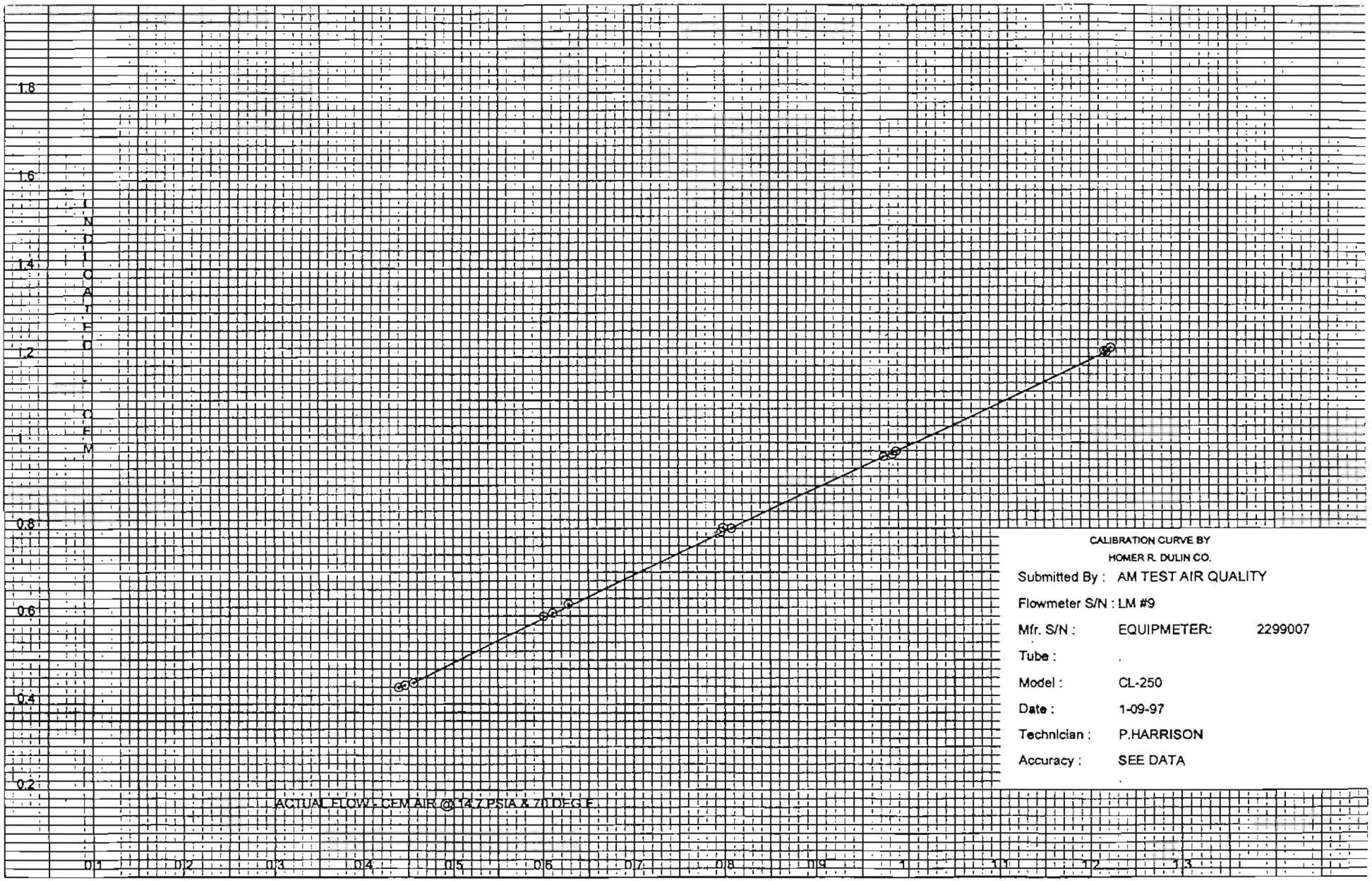
Our standards are certified by or are traceable to the National Institute of Standards and Technology and comply with MIL-STD 45662A and ANSI/NCSL Z540-1.

The collective uncertainty of the standards used in this calibration does not exceed 25% of the certified accuracy of the instrument under test.

P.O. No 33893 Shipper No. .

1-09-97	1-09-98	P.HARRISON P. Harrison
CALIBRATION DATE	RECALIBRATION DATE	CALIBRATION TECHNICIAN

AGCS2M003338 S300753



S300754

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AGCS2M003339

TYPE S PITOT TUBE INSPECTION DATA FORM

Date December 26, 1995 Pitot Tube # P6E

Client _____

Location ASH GROVE CEMENT COMPANY SEATTLE, WA

Site(s) MAIN CEMENT KILN STACK

Test Date(s) 3/24 - 3/26/97

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = <3 ° (<10°), α_2 = <3 ° (<10°), β_1 = <1 ° (<5°),

β_2 = <1 ° (<5°)

γ = _____ °, θ = _____ °, A = _____ cm (in.)

z = A sin γ = <0.005" cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = <0.005" cm (in.); <.08 cm (<1/32 in.)

P_A 0.535 cm (in.) P_b 0.534 cm (in.)

D_t = 0.375" cm (in.)

Comments:

New Pitot tube

Calibration required? _____ yes* _____ no

*If yes, tag and take out of service until repaired.

TYPE S PITOT TUBE INSPECTION DATA FORM

Date December 8, 1995 Pitot Tube # P5K

Client _____

Location ASH GROVE CEMENT COMPANY SEATTLE, WA

Site(s) MAIN CEMENT KILN STACK

Test Date(s) 3/24-3/26/97

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = <3 ° (<10°), α_2 = <3 ° (<10°), β_1 = <1 ° (<5°),

β_2 = <1 ° (<5°)

Y = _____°, θ = _____°, A = _____ cm (in.)

z = A sin Y = <0.005" cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = <0.005" cm (in.); <.08 cm (<1/32 in.)

P_A 0.522" cm (in.) P_b 0.522" cm (in.)

D_t = 0.375" cm (in.)

Comments:

New Pitot tube

Calibration required? _____ yes* _____ no

*If yes, tag and take out of service until repaired.

Thermocouple I.D. T6E

Thermocouple Calibration Data Sheet

Date 1-12-96
Initials DCS
Ambient Temperature 69 °F
Barometric Pressure 29.65 "Hg

T.C. Indicator Fluke 52
Reference I.D. Mercury in Glass

	Reference Temperature*	Thermocouple Temperature*	Temperature Difference**	
	°F	°F	°F	%
Ice Bath	32	33	1	0.2
	32	33	1	0.2
	32	33	1	0.2
Boiling Water 2-5-96	210	205	5	0.7
	210	205	5	0.7
	210	205	5	0.7
Hot Oil 2-5-96	284	286	2	0.3
	284	286	2	0.3
	284	286	2	0.3

*Readings taken at one minute intervals

** (ref. temp.°F + 460) - (test T.C. temp.°F + 460)/(ref.temp.°F + 460) x 100 < 1.5

Thermocouple I.D. T5K

Thermocouple Calibration Data Sheet

Date 1·12·96
Initials DCJ
Ambient Temperature 69 °F
Barometric Pressure 29.65 "Hg

T.C. Indicator Fluke 52
Reference I.D. Mercury in Glass

	Reference Temperature*	Thermocouple Temperature*	Temperature Difference**	
	°F	°F	°F	%
Ice Bath	32	33	1	0.2
	32	33	1	0.2
	32	33	1	0.2
Boiling Water 2-5-96	210	205	5	0.7
	210	205	5	0.7
	210	205	5	0.7
Hot Oil 2-5-96	300	310	10	1.3
	300	310	10	1.3
	300	310	10	1.3

*Readings taken at one minute intervals

** (ref. temp.°F + 460) - (test T.C. temp.°F + 460)/(ref.temp.°F + 460) x 100 < 1.5

SECTION 1. DESCRIPTION

1.1 General

The Servomex 1400B series of gas analysers comprises two base units, the 1410B analyser using dual wavelength, single beam infrared technique and the 1420B/1421B oxygen analysers using paramagnetic technology. This manual describes the 1420B oxygen analyser.

The 1400B series may be fitted into a twin unit 19" rack mounted case, a bench top case or a single unit case for flush panel mounting.

The 1420B has voltage and current outputs, multiple ranges, oxygen level alarms, flow alarm and remote range indication.

A version of the analyser is available for oxygen purity measurements.

Included with the analyser are the following accessories:

Fuses	2531-0526
Filters	2377-3608
'D' connectors	2535-7127 (plug)
	2535-7374 (socket)
'D' connector hoods	2535-7088
Manual	01420001B
IEC Power connector	2533-1437

A 3 1/2 digit green LED indicates the oxygen content to 0.1% resolution.

WARNING

This analyser is not suitable for use in hazardous areas or for measuring flammable sample gases.

1.2 Principles of Operation

The 1420B oxygen analyser measures the paramagnetic susceptibility of the sample gas by means of a magneto-dynamic type measuring cell.

Oxygen is virtually unique in being a paramagnetic gas, this means that it is attracted into a magnetic field. In the Servomex measuring cell the oxygen concentration is detected by means of a dumb-bell mounted on a torque suspension in a strong, non-linear magnetic field. The higher the concentration of oxygen the greater this dumb-bell is deflected from its rest position. This deflection is detected by an optical system and twin photo-cells connected to an amplifier. Around the dumb-bell is a coil of wire. A current is passed through this coil to return the dumb-bell to its original position. The current is measured and is proportional to the oxygen concentration.

1.3 Sampling System

The sampling system of the analyser includes a combination filter/automatic flow control device, designed to keep a constant flow of sample gas through the measuring cell for varying input pressures and to prevent the entrance of particulate matter into the measuring cell. Excess flow is vented to the by-pass.

An optional back pressure regulator is available for high oxygen concentrations to reduce the errors which would occur due to changes in barometric pressure.

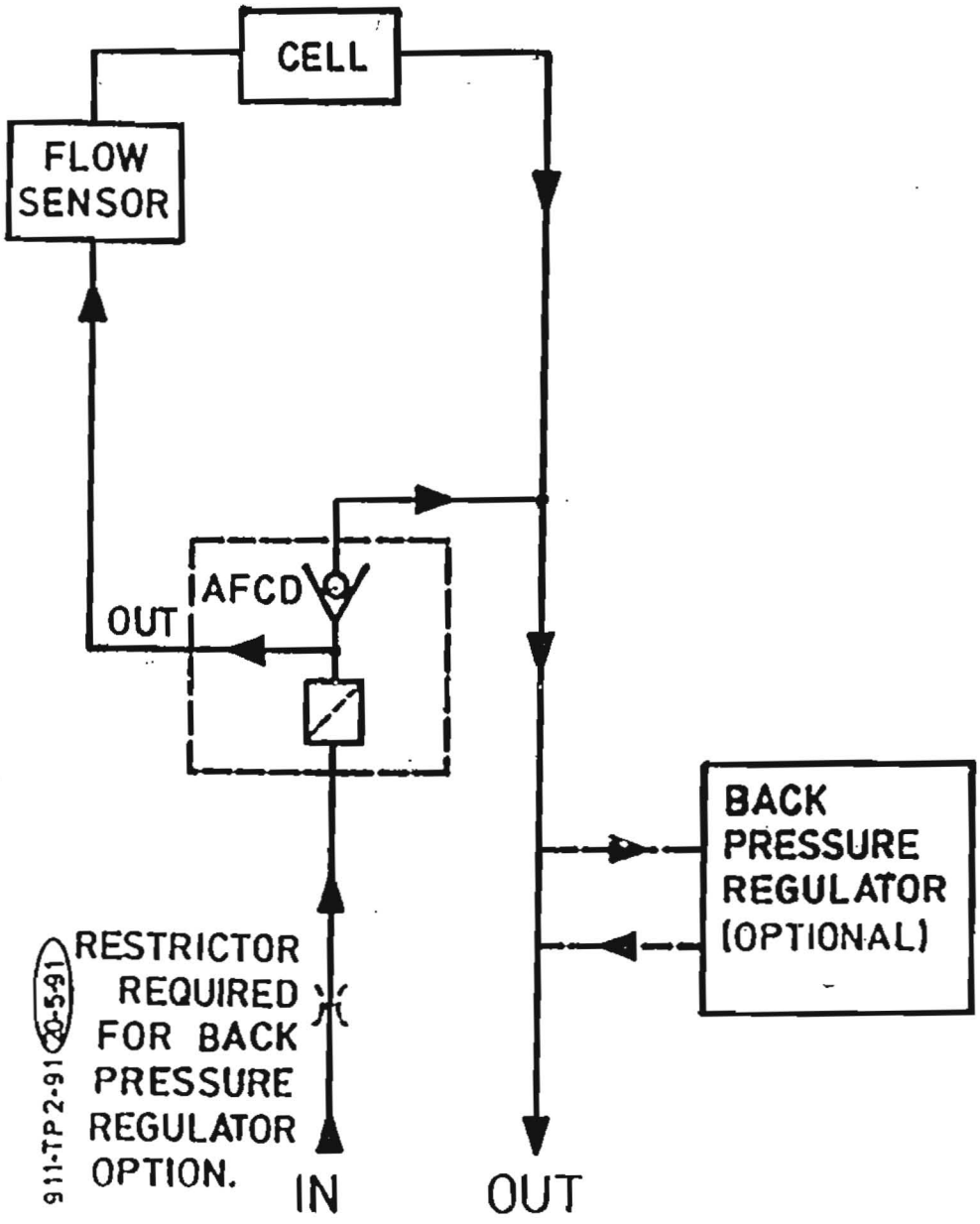


Figure 1.1 Schematic of Sampling System

1.4 Use With Toxic or Flammable Gases

1.4.1 Toxic Gases

If the analyser is used with sample gases which may be toxic, asphyxiant or otherwise harmful to health then adequate precautions should be taken to ensure safe installation and operation.

These precautions could, for example, include ensuring good quality sample piping to reduce the possibility of leaks, regular leak checking of the analyser and sample piping, minimum sample pressure, adequate ventilation of enclosed spaces and the possibility of monitoring for toxic levels.

The analyser vent should be piped to a well ventilated area.

1.4.2 Flammable Gases

WARNING

This analyser is not suitable for use in hazardous areas or for measuring flammable sample gases.

Consult Servomex for details of analysers which may be more suitable for measuring sample gases which can be toxic or flammable.

1.5 Specification

Performance Specification (typical)

Repeatability:	Better than ±0.1% O_2 under constant conditions (measured at the IV electrical output).
Temperature coefficient:	±0.005% O_2 ±0.04% of reading(on display) per °C change from calibration temperature.
Response Time:	Less than 15 seconds to 90%. At point when flow alarm is triggered the response time will be approximately 50 seconds

Outputs

Display:	3 1/2 digit LED reading 0.0 to 100.0% oxygen with overrange capability.
Output:	4-20mA (isolated), maximum load 600 ohms. Isolation 110V ac. 0-1V (unisolated), minimum load 1000 ohms for range selected.

Alarm outputs:

Oxygen level:	2 oxygen level alarms, SPCO relay contacts rated at 1A/110V AC or 1A/28V DC, non-inductive. Can be configured to high or low. Independent of range.
Flow fail:	SPCO relay contacts rated at 1A/110V AC or 1A 28V DC, non-inductive.
Local alarm:	Red LED lamps flash when alarm active.

Sample requirements

Condition:	Clean, dry gas with dew point 5°C below ambient temperature.
Inlet pressure: (Standard)	3.5 to 70kPa (0.5 to 10psig). Inlet pressure changes within this range will change the reading by less than 0.1% O_2.
(With back-pressure regulator)	17kPa to 35kPa (2.5 to 5 psig). Pressure values will be increased by 1 psig for every 2000ft(10Pa per 1000m) altitude above sea level.
Flowrate:	1 to 6 litres/minute approximately depending on sample pressure. Version with back pressure regulator: 1 - 2 litres/min
Filtering:	0.6 micron replaceable filter integral to the automatic flow control device.
Materials exposed to the sample:	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, Viton, nylon, neoprene, polypropylene and glass fibre filter.
Gas connection:	6.4mm (1/4") OD tube.

Physical Characteristics

Case:	Steel and aluminium finished in epoxy powder paint.
Case classification:	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case.

Dimensions:	See Figure 2.1.
Weight:	5Kg (11lb) approximately.

Electrical

AC Supply:	88 to 264V, 47 to 440Hz.
Power required:	50VA.

Environmental Limits

Operating ambient temperature:	0 to +45°C (32 to 113°F) 0 to 40°C (32 to 104°F), when fitted in bench top case.
Storage temperature range:	-20 to +70°C (-4 to 158°F)
Relative humidity:	0-85%, non-condensing.
Sunlight:	Protect from direct sunlight which may cause the interior of the analyser to overheat.
Vibration:	Protect the analyser from excessive vibration.
EMC:	Complies with EN 50022(1987) CLASS A for conducted interference and radiated electric field.

1.6 Product Identification

A label is fitted to the rear panel giving the model and serial numbers. It is of the form 1420/B701/NNNN where NNNN is the serial number

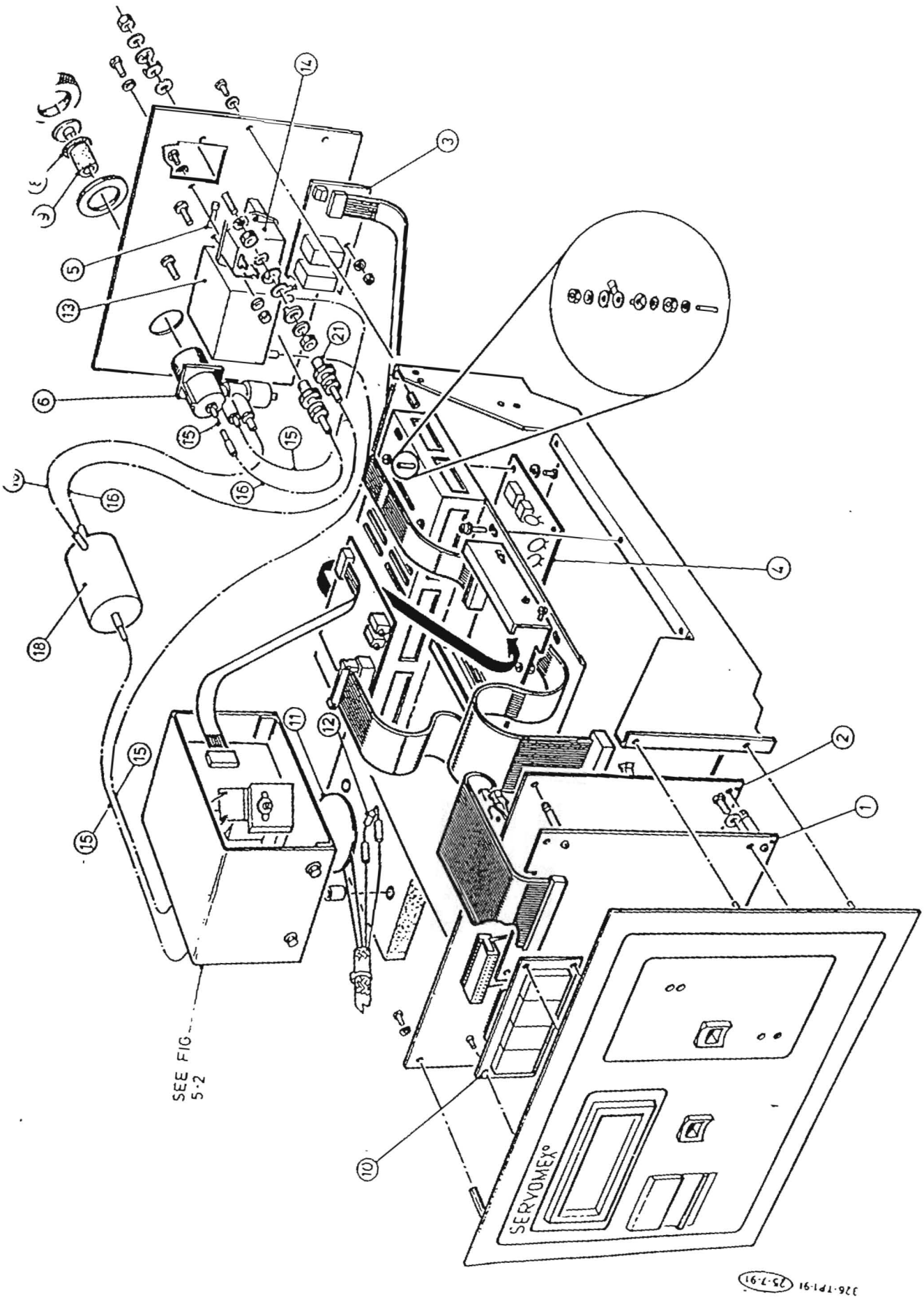


Figure 5.1 Exploded View 1420B Oxygen Analyser **AGCS2M003349** S300764

Servomex

1410B
Infrared Analyser
Instruction Manual

Ref : 01410/001B/0
Order as part No. 01410001B

Certificate No. Q5166
ISO 9001 (1987)
EN 29001 (1987)

CUSTOMISED CIRCUIT VARIABLES

The 1400 display pcb (01410902/0) on this instrument is fitted with ~~standard~~/special resistor values and switch settings, as follows :-

Resistors

R8	~~8K0~~/
R9	9K0
R10	~~1K0~~/
R11	500R
R12	500R
R13	500R
R14	500R
R15	500R

Special Switch 1 Settings

1/1	ON
1/2	ON
1/3	OFF
1/4	ON
1/5	ON
1/6	ON
1/7	ON
1/8	ON

Standard Switch 1 settings are listed on Page 18 of the manual.

Section 1. Description and Specification.

1.1 General

This manual describes the Servomex 1410 infra-red gas analyser.

The 1410 is supplied for packaging into a 19 inch rack , 4U high, case. A suitable case is available from Servomex, part number 00022905.

If the 1410 is not fitted into a suitable protective case by Servomex (eg. when the 1410 is supplied as an OEM chassis) it is then the responsibility of the user to ensure that suitable precautions are taken so that the level of protection is adequate for the intended environment.

A 3 1/2 digit LED display indicates the gas concentration

The analyser has built-in alarms for flow failure, instrument fault and high concentration level. These alarms have indicating LED's on the front panel. An alarm relay is fitted inside the unit and can be selected by the user to operate on any one of these alarm conditions.

A switch on the analyser's front panel selects the measurement range. Pins on the rear of the analyser allow connection of a remote range change switch which, if connected, overrides the front panel switch.

> WARNING
>
> **This analyser is not suitable for use in hazardous areas or for measuring hazardous gas mixtures**

1.2 Specification

Principle:	Infra-red. Single beam dual wavelength.
Accuracy:	Subject to available standards or gas mixtures. Typically better than +/- 2% FSD.
Linearity:	Better than +/- 1% FSD.
Repeatability:	Better than +/- 1% FSD
Zero drift:	Less than 2% FSD per week
Effect of sample cell contamination:	Less than 1% FSD for 50% cell window obscuration, due to broad band contamination.
Temperature coefficient:	Zero - less than 0.2% FSD per deg C Span - less than 0.4% of reading

Sample pressure coefficient:	Less than 0.15% of reading per mbar
Response time:	Typically 30 seconds to 90%.
Electrical output:	0 to 1V, isolated, min load 1K and 4 to 20mA, isolated, max load impedance 500R. Note that the current and voltage outputs are not isolated from each other.
Operating ambient temperature:	0 to 40 deg C (32 to 104 deg F).
Relative humidity:	5 to 85% non-condensing.
Storage temperature:	-20 to +70 deg C (-4 to 158 deg F).
Storage relative humidity:	80% RH maximum.
AC supply;	120 or 240V AC, +/-10%, 45/65Hz. Max load 30VA.

Alarms

Instrument/level/ flow alarm:	This alarm can be configured to operate in different ways:- 1. As a concentration alarm only 2. As an instrument fault alarm only 3. As a flow alarm 4 sets of changeover relay contacts rated at 3A/120V, 1A/240V AC or 1A/28V DC. Relay de-energises on alarm or power failure. See section 2.3.1 for details of how to configure these alarms.
Additional Gas Concentration Alarm:	Change over relay contacts rated at 1A/28V AC or DC . Relay de-energises on high concentration or power fail.

Sample Requirements

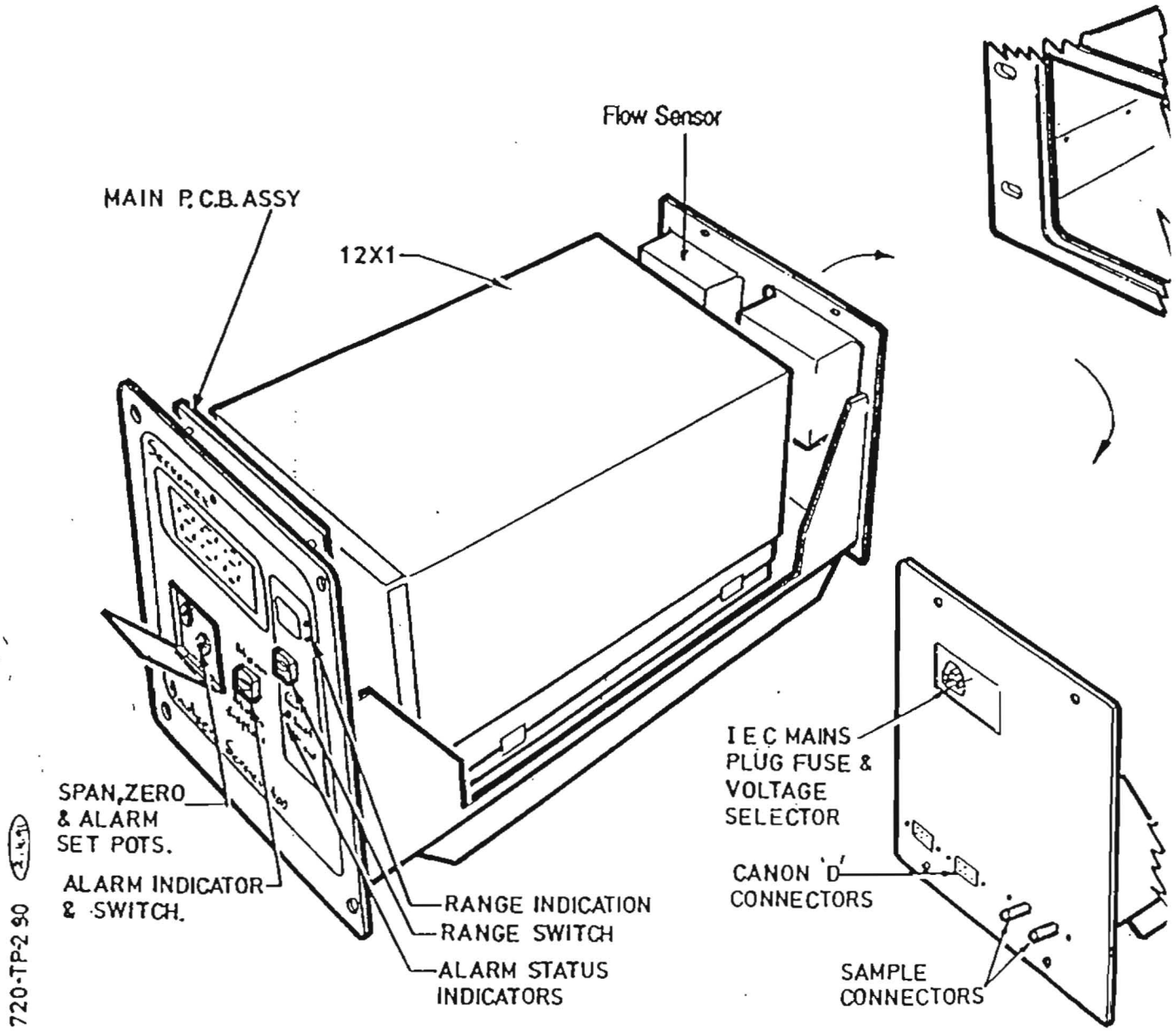
Pressure:	0.9 to 1.1 bar absolute.
Flowrate:	Typically 100ml/min to 1 litre/min.
Materials in contact with the sample:	Stainless steel, Viton, sapphire/CaF2, UPVC, as standard.
Gas connection:	6.4mm (1/4in) OD tube, suitable for push-on tubing or 1/4 inch compression fittings.

Section 4. Principles Of Operation And Product Description

4.1 Description Of The 1410

The 1410 analyser comprises two major assemblies:-

1. 12X1 infrared bench (see appendices A-D)
2. Front panel assembly (see figure 4.1)



AGCS2M003354

Figure 4.1 General Construction

CC- 34923

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SO-CAL Airgas

BYRNE SPECIALTY GASES
601 SOUTH ANDOVER STREET • SEATTLE, WASHINGTON USA 98108
206.621.8400

ANALYTICAL REPORT - PRODUCT CERTIFICATION

TO:
Byrne Specialty Gas Co.

Date: 01 March 1996

P.O.: SP-5457-64548

+/- 1 Percent Analytical,
EPA Traceability Protocol For Assay And Certification
of Gaseous Calibration Standards Procedure G-1.

CYLINDER NO.	CONSTITUENTS CONCENTRATION:	NOMINAL	ACTUAL
CC34923	Carbon Dioxide	12.00 %	12.0 %
	Oxygen	12.00 %	12.0 %
	Carbon Monoxide	600 PPM	602 PPM
	Nitrogen	Balance	Balance

Certification Period (months) : 36
Expiration Date : 01 Mar 1999
Cylinder Pressure: 700 psia
DO NOT USE BELOW 150 PSIG

Airgas

Claude J. Vahle
ANALYST

S300770

AGCS2M003355

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SO-CAL Airgas

BYRNE SPECIALTY GASES
601 SOUTH ANDOVER STREET • SEATTLE WASHINGTON USA 98108
206.621.8400

ANALYTICAL REPORT - PRODUCT CERTIFICATION

TO:

Byrne Specialty Gas Co.

Date: 01 March 1996

P.O.: SP-5457-64548

Page 2 of 4 analyzer readings

CYLINDER NO.	CONSTITUENTS	CONCENTRATION: NOMINAL	ACTUAL
T591121	Carbon Dioxide	15.0 %	14.01 %
GMIS	Nitrogen	Balance	Balance
Sample			

Analyzer: Siemans Ultramat 5E
Seriial No.: 40329
Range: 0-25.0 %
Sample cylinder No.: CC34923

Date of last multipoint calibration: 02-23-96

Measurement Principle: Infrared

Date: 02-23-96		
Zero: 00.0	Reference: 54.4	Sample: 46.6
Reference: 54.4	Zero: 00.0	Sample: 46.6
Zero: 00.0	Sample: 46.6	Reference: 54.4
Carbon Dioxide: 12.0	Carbon Dioxide: 12.0	Carbon Dioxide: 12.0

% deviation of Carbon Dioxide from mean: 0.00%
Reported analysis: Carbon Dioxide: 12.0 %

Claude J. Vahle

Claude J. Vahle
ANALYST

AGCS2M003356 S300771

P D -042 9/93

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SO-CAL Airgas

BYRNE SPECIALTY GASES
601 SOUTH ANDOVER STREET • SEATTLE, WASHINGTON USA 98108
206.621.8400

ANALYTICAL REPORT - PRODUCT CERTIFICATION

TO:

Byrne Specialty Gas Co.

Date: 01 March 1996

P.O.: SP-5457-64548

Page 3 of 4 analyzer readings

CYLINDER NO.	CONSTITUENTS	CONCENTRATION: NOMINAL	ACTUAL
CC21240	Oxygen	10.0 %	9.986 %
GMIS	Nitrogen	Balance	Balance
Sample			

Analyzer: Beckman Oxygen Analyzer
Seriial No.: 1000292
Range: 0-10.0 %
Sample cylinder No.: CC34923

Date of last multipoint calibration: 02-23-96

Measurement Principle: Paramagnetic

Date: 02-23-96

Zero: 00.0	Reference: 46.9	Sample: 59.6
Reference: 49.6	Zero: 00.0	Sample: 59.6
Zero: 00.0	Sample: 59.6	Reference: 49.6
Oxygen: 12.0	Oxygen: 12.0	Oxygen: 12.0

% deviation of Oxygen from mean: 0.00%
Reported analysis: Oxygen: 12.0 %

Claude J. Vahle
ANALYST

AGCS2M003357

S300772

P D -042 9/93

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SO-CAL Airgas

BYRNE SPECIALTY GASES
501 SOUTH ANDOVER STREET • SEATTLE WASHINGTON USA 98108
206.621.8400

ANALYTICAL REPORT - PRODUCT CERTIFICATION

TO:
Byrne Specialty Gas Co.

Date: 01 March 1996

P.O.: SP-5276-61338

Page 4 of 4 analyzer readings

CYLINDER NO.	CONSTITUENTS	CONCENTRATION: NOMINAL	ACTUAL
300-178187	Carbon Monoxide	1000 PPM	971.8 PPM
GMIS	Nitrogen	Balance	Balance
Sample			

Analyzer: Siemans Ultramat 5E
Serial No.: B02-777
Range: 0-1000 PPM
Sample cylinder No.: CC34923

Date of last multipoint calibration: 02-23-96

Measurement Principle: Infrared

Date: 02-23-96

Zero: 00.0	Reference: 77.8	Sample: 48.1
Reference: 77.8	Zero: 00.0	Sample: 48.1
Zero: 00.0	Sample: 48.1	Reference: 77.8
Carbon Monoxide: 601	Carbon Monoxide: 601	Carbon Monoxide: 601

% deviation of Carbon Monoxide from mean: 0.00%

Date: 03-01-96

Zero:00.0	Reference: 78.3	Sample: 48.5
Reference: 78.3	Zero: 00.0	Sample: 48.5
Zero: 00.0	Sample: 48.5	Reference: 78.5
Carbon Monoxide: 602	Carbon Monoxide: 602	Carbon Monoxide: 602

% deviation of Carbon Monoxide from mean: 0.00%

Reported analysis: Carbon Monoxide: 602 PPM
% deviation of average analysis 0.2 %

Claude J. Vahle
ANALYST

AGCS2M003358 S300773

P D -042 9/93

AMTEST AIR QUALITY, LLC

RESUME OF KRIS A. HANSEN, QEP

PRESIDENT
AM TEST-AIR QUALITY, LLC

EDUCATION

- B.S., Chemistry, Central Washington University, 1973
- Coursework and 2.5 years research completed towards M.S., Chemistry, Central Washington University
- Several workshops, courses and conferences annually on the subjects of CEMS/PEMS/CAM Rule, the Clean Air Act Amendments, and advanced emissions measurement.

PROFESSIONAL MEMBERSHIPS/CERTIFICATIONS

- Institute of Professional Environmental Practice (IPEP), Qualified Environmental Professional (QEP), July 1995
- Air and Waste Management Association (A&WMA), member since 1978
- Pacific Northwest International Section of A&WMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Am Test-Air Quality, LLC was formed under the direction of Mr. Hansen in 1982. This company conducts full-service source testing activities. Mr. Hansen follows developments in EPA testing methodology and has developed sampling and analysis techniques for many sources for which EPA guidelines are not available. He has worked at numerous types of industrial facilities throughout the United States and internationally. Mr. Hansen manages an experienced field testing and laboratory analysis staff. He manages all phases of project development, including cost estimation, scheduling, sample collection, analysis and report preparation. He also manages all other aspects of the business, including business development and personnel issues.

Prior to joining Am Test, Inc., Mr. Hansen's professional experience included 4.5 years with an environmental consulting firm, and 2 years as a laboratory instructor and research fellow while attending graduate school at Central Washington University, where his research emphasis was in gas chemistry. Mr. Hansen has 18 years of professional experience.

Mr. Hansen has assisted in the instruction of EPA Air Pollution Training Institute (APTI) courses offered by the EPA in cooperation with the University of Washington. Mr. Hansen was the recipient of the 1987 PNWIS/APCA "Hardhat Award" which was presented in recognition of his contributions to the advancement of source sampling technology in the Pacific Northwest. He is a current board member of the Puget Sound Chapter of PNWIS/A&WMA. In 1995, Mr. Hansen received his Qualified Environmental Professional (QEP) certification. Through the QEP certification, environmental professionals demonstrate their breadth and depth of knowledge and experience, and commit to abide by the Code of Ethics of the Institute of Professional Environmental Practice (IPEP). Mr. Hansen is the Regional Coordinator (Washington and Alaska) for QEP certification testing.

AM TEST
AIR QUALITY, LLC

RESUME OF
ANGELA F. BLAISDELL

VICE PRESIDENT/SR. TECHNICAL WRITER

EDUCATION

- B.S., Marine Resources, Western Washington University, Bellingham, Washington, 1980
- Minors in Chemistry and Biology
- Several workshops, courses and conferences annually, including a Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke in October 1992 and April 1993, a Title V Operating Permits Workshop in May 1993, an Advanced Emission Measurement Workshop in July 1993, a Title III MACT Workshop in 1994 and Enhanced Monitoring Workshops in 1993 and 1994.

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (A&WMA)
- Pacific Northwest International Section of A&WMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Ms. Blaisdell has worked with Am Test-Air Quality, LLC since 1984 and has over 15 years of professional experience in the field of air quality. She helps manage all aspects of source test projects, including initial client contact, scope of work preparation, scheduling, pre-test coordination, implementation of quality assurance programs for field sampling, analysis, data reduction, final data review and report preparation and review. She reviews current literature for each test method and incorporates the methodology into our testing and reporting protocol. Ms. Blaisdell has assisted in the instruction of the EPA-APTI 464L "Continuous Emission Monitoring" course, the EPA 450 "Source Sampling for Particulate Pollutants" course, and the EPA 502 Course "Hazardous Waste Incineration" offered by the EPA's Air Pollution Training Institute in cooperation with the University of Washington. She was the General Chair of the 1994 PNWIS Spring Specialty Conference on Enhanced Monitoring, and was a speaker at the 1990 and 1991 PNWIS annual meetings on the subject of continuous emission monitoring systems (CEMS). Angela is the current Treasurer and past secretary/treasurer for the Pacific Northwest International Section (PNWIS) of the Air and Waste Management Association (A&WMA) and is the past Chair for the Puget Sound Chapter of PNWIS. Ms. Blaisdell was the recipient of the 1991 PNWIS/A&WMA "Labcoat Award" which is presented each year to an individual to recognize his contribution to the advancement of source sampling methodology in the Pacific Northwest.

Prior to joining Am Test, Ms. Blaisdell acted as a Project Leader and Office Manager for an environmental engineering consulting firm in the Seattle area for 2 years. Experience with that firm involved sample collection, analysis and report preparation for source and ambient air, water and industrial hygiene studies. Ms. Blaisdell also worked on various research projects in the Chemistry department while attending Western Washington University.

AMTEST
AIR QUALITY, LLC

RESUME OF
JAMES A. GUENTHOER

SENIOR PROJECT ENGINEER

EDUCATION

- B.S., Geology, Juniata College, Huntington, Pennsylvania, 1972
- M.S.E., Environmental Engineering Division, Department of Civil Engineering, University of Washington, Seattle, Washington, 1985
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.

PROFESSIONAL MEMBERSHIPS

- Pacific Northwest International Section of AWMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Mr. Guenthoer has been a Project Engineer for Am Test-Air Quality, LLC since 1983 and has over 19 years of professional experience. Mr. Guenthoer specializes in performing field sampling for source emission evaluations. He is experienced in the collection of samples to be analyzed for particulate matter, particle size distribution, sulfur and nitrogen oxides, hydrogen sulfide, semi-volatile and volatile organic compounds (including dioxins and furans), toxic air pollutants, and other chemical species. Mr. Guenthoer was the recipient of the 1989 PNWIS/APCA "Hardhat Award" which is presented each year to an individual to recognize his contribution to the advancement of source sampling technology in the Pacific Northwest.

Mr. Guenthoer was formerly the Operations Manager for Pollution Control Systems, Inc. of Seattle, Washington for 4 years and handled the design, technical services and sales of in-stack source test Cascade impactors. He assists in the instruction of EPA 450 and EPA 468 Source Sampling Short Courses for particulate and gaseous pollutants which are offered each year by the EPA in cooperation with the University of Washington. He has also assisted in presenting workshops to demonstrate the use of in-stack source test Cascade impactors.

Mr. Guenthoer was formerly associated with Air Pollution Systems of Kent, Washington conducting research and development studies on novel particulate control technology. Prior to his association with Air Pollution Systems, Mr. Guenthoer was the Testing Manager for Rossnagel and Associates of Medford, New Jersey and was in charge of all water quality, industrial hygiene, and source testing for 3 branch offices. During his 5 years with this environmental testing firm, Mr. Guenthoer has conducted compliance source tests for local, state and federal government in over 40 states and in Canada and served as a professional expert witness in environmental legal cases.

AM TEST
AIR QUALITY, LLC

RESUME OF
KEVIN P. ORTON

SENIOR AIR QUALITY SPECIALIST

EDUCATION

- Kern Occupational Center
  Graduate of Telecommunications
  Bakersfield, California
- Continuous Emission Monitoring System (CEMS) Workshop,
  taught by Dr. James Jahnke, April 1993.

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Mr. Orton has worked for Am Test-Air Quality LLC since 1992 as a Senior Air Quality Specialist, and has over 10 years experience in the field of air quality and industrial source emissions testing. Mr. Orton conducts source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, test planning and preparation, and data reduction and evaluation. He has performed sampling for particulate matter, particle size distribution, sulfur and nitrogen oxides, reduced sulfur compounds, semi-volatile and volatile organic compounds, toxic air pollutants, metals and other EPA methodology. In the laboratory and office, he performs test equipment trouble-shooting, maintenance, fabrication, and calibration.

Prior to joining Am Test-Air Quality, LLC, Mr. Orton was a Senior Field Technician for Genesis Environmental Services Company in Bakersfield, California for 2 years. This company performed work primarily for the petroleum industry, which involved conducting instrumental test methods and wet test methods at boilers, vapor recover systems, cogeneration units, refinery process streams, internal combustion engines, and other stationary and non-stationary (e.g., tanker ships) sources of emissions. Mr. Orton also performed equipment calibrations and QA/QC procedures for source testing and laboratory data.

Prior to his position with Genesis Environmental, Mr. Orton was a Senior Field Technician for Sierra Environmental Engineering, Inc. in Costa Mesa, California for 4 years. He tested a variety of production processes at various facilities including, refineries, petro chemical, smelters, gas furnaces, power generation facilities (including gas, oil, coal, and biomass), and the automobile industry. In this position, Mr. Orton performed a wide variety of EPA California Air Resources Board (CARB) tests methods and also worked in their analytical laboratory performing chemical, quantitative and photometric analyses as well as gas chromatography.

AMTEST
AIR QUALITY, LLC

RESUME OF
E. RAY LAWRENCE

SENIOR AIR QUALITY SPECIALIST

EDUCATION

- EPA 450 "Source Sampling for Particulate Pollutants Course", August 1992.
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.

PROFESSIONAL EXPERIENCE

Mr. Lawrence began his employment with Am Test-Air Quality, LLC in 1992. He conducts source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, test planning and preparation, and data reduction and evaluation. In the laboratory and office, he performs test equipment trouble-shooting, maintenance, fabrication, and calibration. He helps keep the Air Quality shop and mobile laboratories organized and stocked with the necessary sampling supplies and parts.

Mr. Lawrence is experienced at performing the following test methods: EPA Methods 1, 2, 3A, 4, 5, 6, 6C, 7, 7E, 8, 10, 11, 12, 13B, 16A, 17, 20, 23, 25A, 25B, 26, 26A, 29 (multiple metals sampling), 101A, 201A, 202, 306, 308, semi-volatile organic compound sampling (including dioxins and furans), volatile organic compound testing by VOST or TO-14, particle size distribution, continuous emission monitoring systems certifications, and other miscellaneous EPA methodology.

AM TEST
AIR QUALITY, INC.

RESUME OF
PAUL J. CLARK

AIR QUALITY SPECIALIST

EDUCATION

- Naval Nuclear Power School, 1982
- Various Naval Engineering Courses
- Numerous Safety and Hazard Communication Courses
- OSHA 80-Hour Hazardous Waste Training, 1993

PROFESSIONAL EXPERIENCE

Mr. Clark began his employment with Am Test-Air Quality, Inc. in January, 1995. He conducts source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, test planning and preparation, and data reduction and evaluation. In the laboratory and office, he performs test equipment trouble-shooting, maintenance, fabrication, and calibration. He helps keep the Air Quality shop and mobile laboratories organized and stocked with the necessary sampling supplies and parts.

Mr. Clark is experienced at performing the following test methods: EPA Methods 1, 2, 3A, 4, 5, 6, 6C, 7E, 8, 10, 11, 12, 13B, 16A, 17, 20, 23, 25A, 25B, 26, 26A, 29 (multiple metals sampling), 101A, 201A, 202, semi-volatile organic compound sampling (including dioxins and furans), volatile organic compound testing by TO-14, particle size distribution, continuous emission monitoring systems certifications, and other miscellaneous EPA methodology.

Prior to joining Am Test-Air Quality, Inc., Mr. Clark was an Environmental Technician for several Seattle based companies, including Chempro, Airco Services, Inc. and Penberthy Electromelt International, Inc. Mr. Clark also worked as a Shift Supervisor at Penberthy Electromelt, a hazardous waste thermal treatment unit and as a Field Supervisor at Airco Services, Inc. His responsibilities have included the organization and demobilization of 2-12 person crews for emergency spill response, site remediation and industrial cleaning as well as the development and implementation of safety training programs. In 1987, Mr. Clark was honorably discharged by the U.S. Navy after 6 years of active duty with a rank of E-6 and the position of Leading Petty Officer for the Reactor Laboratory Division aboard a Nuclear Powered Submarine.

AM TEST
AIR QUALITY, LLC

RESUME OF
JUDITH A. AASLAND

SENIOR TECHNICAL WRITER

EDUCATION

- Coursework partially completed towards B.S., Business Administration Washington State University, 1982-1984
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.
- Enhanced Monitoring Workshop, May 1994

PROFESSIONAL EXPERIENCE

Ms. Aasland has worked for Am Test-Air Quality, LLC since 1992 and has had over 7 years of experience in providing administrative support in the environmental industry. In the office, Ms. Aasland assists with project coordination, performs data reduction, data review and report preparation for the senior reviewers. She also assists in word processing of proposals and test plans and performs numerous administrative duties to keep the air quality office organized and operating efficiently.

Prior to joining Am Test-Air Quality, LLC, Ms. Aasland was an Office Manager for Am Test, Inc.'s Redmond laboratory for 3 years. In this position, Ms. Aasland coordinated office support personnel in report and invoice generation and provided administrative support services to the General Manager.

Prior to her employment at Am Test, Ms. Aasland worked for several small businesspersons as an Office Manager for 3 years. In this position, Ms. Aasland provided word processing, full-charge bookkeeping and personnel support services for each businessperson.

AMTEST
AIR QUALITY, LLC

RESUME OF
CHRISTINE L. RAMSEY

TECHNICAL WRITER/CHEMIST

EDUCATION

- B.S., Biology and Psychology, Virginia Polytechnic Institute and State University, 1989
- Cooperative Education Program Certificate, Virginia Polytechnic Institute and State University, 1989

PROFESSIONAL MEMBERSHIPS

- Pacific Northwest International Section of A&WMA (PNWIS)

PROFESSIONAL EXPERIENCE

Ms. Ramsey began her employment with Am Test-Air Quality, LLC in June 1996. In the office, Ms. Ramsey reduces field data and inputs values into data reduction programs and performs by-hand calculations to verify computer program integrity. She will also be trained to perform technical writing of source test reports.

In the laboratory, Ms. Ramsey is experienced in gravimetric analysis of particulate matter samples and particle size distribution samples and solvent extractions.

Prior to her employment with Am Test, Ms. Ramsey worked as a temporary employee through Lab Temps in assorted contract positions, which included Ostex International in Seattle, and the Ste. Michelle Winery in Woodinville, Washington. Prior to that she was a Section Leader for the Conventional Chemistry & Microbiology department at Pacific Northern Analytical in Redmond, Washington for nearly 2 years. Ms. Ramsey has also worked as a contract employee to Wacker Siltronic in Portland, Oregon and to LAPTEFF Associates, Consulting Engineers in Woodbridge, Virginia as a chemist/microbiologist. During college, she worked as a physical science technician for the US Food and Drug Adminstration.

AMTEST
AIR QUALITY, LLC

AM TEST-AIR QUALITY, LLC
CAPABILITIES

Am Test-Air Quality, LLC is an independent company providing comprehensive air pollution testing services to industry and government. Am Test, Inc.'s Air Quality Division was developed in 1982 by Mr. Kris A. Hansen. On January 1, 1991, the Air Quality Division incorporated as a separate company named Am Test-Air Quality, Inc. On October 1, 1995, Am Test-Air Quality, Inc. formed a limited liability company (LLC) named Am Test-Air Quality, LLC. Am Test-Air Quality, LLC's main office and laboratory facility is located in Preston, Washington. The Preston office employs a staff of 18 qualified, experienced engineers, chemists and scientists. One aspect of the testing services provided by Am Test-Air Quality, LLC which we feel is unsurpassed by other testing firms, is the quality and experience of our personnel. We utilize highly experienced, motivated personnel on all projects. We believe that the success of a project is dependent on the use of state-of-the-art equipment and experienced, knowledgeable personnel. We have performed source testing projects of all different sizes and difficulty levels. Typically, we dispatch test teams of one to ten individuals. On all projects, our attention to detail remains extremely high.

Am Test-Air Quality, LLC performs source testing projects at all types of facilities throughout the United States and Canada. Some of the types of facilities tested include:

- Oil and Gas Refineries
- Pulp and Paper Mills
- Gas, Oil, Wood, Coal and Nuclear-Fired Power Plants
- Chemical Plants
- Aluminum Reduction Facilities
- Wood Products Industries
- Smelters
- Cement Kilns
- Hazardous Waste Incinerators
- Municipal and Medical Waste Combustors
- Landfill Gas Flares
- Wastewater and Sewage Treatment Facilities
- Coating and Finishing Facilities
- Manufacturers
- Superfund Clean-Up Sites
- Asphalt Plants

AMTEST
AIR QUALITY, LLC

Examples of the types of projects Am Test-Air Quality, LLC becomes involved in include:

- Regulatory compliance with NSPS, MACT, BIF, TSCA, RCRA requirements
- Continuous emission monitoring system (CEMS) certifications and periodic monitoring performance tests
- Enhanced monitor certifications (CEMS, CRMS, CPMS)
- Emission inventories for Title V, MACT, NESHAP, SARA
- FTIR - Real-time Air Toxics
  Analysis of ≈ 100 compounds possible, including Formaldehyde, NH_3, HCl, VOCs, methanol
- Portable Gas Chromatograph (GC with FID/TCD/FPD)
- VOCs, Fixed gases, sulfur compounds
- Title III and SIP determinations
- Air pollution control equipment warranty/guarantee/design testing
- Combustion or control device optimization
- Air toxics studies for hazardous air pollutants (HAPs)
- Particle size distribution studies (PM_{10})
- Soil remediation unit (SRU) evaluations
- Vapor recovery unit (VRU) efficiency evaluations
- Destruction/capture efficiency studies for VOCs
- Ammonia slip evaluations
- Pilot plant or engineering-scale trial burns
- Hands-on stack sampling training workshops
- Industry-agency liaison support

AMTEST
AIR QUALITY, LLC

MANUAL EMISSIONS TESTING SERVICES

Am Test-Air Quality, LLC performs all recognized EPA source test methods for many types of industries. We also perform NIOSH methods, BIF Regulation methods, SW-846 methods, toxic organic (TO) methods and are experienced at developing test methods for specialized applications where published methods do not exist. Am Test personnel keep current on new method development by attending training courses and utilizing the EMTIC bulletin board system (BBS). A partial list of pollutants measured using manual test methods follows:

- Particulate Matter
- Particle Size Distribution
- Sulfur Oxides
- Nitrogen Oxides
- Opacity Measurement
- Carbon Monoxide and Fixed Gases
- Hydrogen Sulfide
- Multi-Metals
  - Hexavalent Chromium
  - ICP Metals
  - Low-Level Mercury
- Particulate and Gaseous Fluoride
- Total Reduced Sulfur Compounds
- Volatile Organic Compounds
  - 8240 list of VOCs
  - Alcohols and Acetates
  - BTEX
  - Formaldehyde/Aldehydes
  - Perfluorocompounds
- Semi-Volatile Organic Compounds
  - Dioxin and Furan Isomers
  - PAHs
  - BNAs
  - PCBs
  - POMs
  - Pesticides and Herbicides
- Acid Gases
  - Hydrochloric Acid
  - Hydrofluoric Acid
  - Nitric Acid
  - Sulfuric Acid
- Chlorine, Chlorine Dioxide and Chloroform
- Ammonia and Urea
- Radionuclides
- Hazardous Air Pollutants (HAPs)

AMTEST
AIR QUALITY, LLC

CONTINUOUS EMISSION MONITORING SYSTEMS AND INSTRUMENTAL TESTING SERVICES

Am Test-Air Quality, LLC has four (4) complete continuous emission monitor (CEM) instrument vans or systems, some of which can be shipped to remote locations. We maintain an inventory of approximately 100 EPA Protocol 1 (or best available grade) certified calibration gas mixtures to tailor calibration gases to each source. Each mobile laboratory is equipped with:

- O_2, CO_2, SO_2, NO_x, and CO analyzers
- Total hydrocarbon (THC) and non-methane hydrocarbon (NMHC) analyzers
- PC-based data acquisition systems for collecting and reducing data to provide on-site results
- Cylinder racks for calibration gases
- Heated or unheated Teflon sample transport lines
- Sample extraction systems, including sample probes, fine particulate filters, moisture removal systems, and Teflon-lined sample pumps
- Laboratory bench space which can be equipped with analytical balances, wet chemical analysis equipment and instrumental methods, including gas chromatography

Am Test-Air Quality, LLC's mobile laboratories are used to perform New Source Performance Standard (NSPS) testing and to conduct continuous emission monitoring system (CEMS) performance specification tests and audits. We provide a variety of CEMS services, including:

- Performance Specification Tests (PST)
- Relative Accuracy Test Audits (RATA)
- Relative Accuracy Audits (RAA)
- Cylinder Gas Audits (CGA)
- Quality Assurance Plans (QAP)

In addition, Am Test-Air Quality, LLC's senior level staff are extremely knowledgeable in the field of CEMS and can assist in monitor selection, calibration gas selection, stratification testing to locate CEMS probes, sampling system troubleshooting, and act as a liaison with the regulatory agency.

For more information, contact Mr. Kris A. Hansen, QEP at Am Test-Air Quality, LLC at (206) 222-7746 for more information or a quotation.

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CC44489

SO-CAL Airgas

BYRNE SPECIALTY GASES
601 SOUTH ANDOVER STREET · SEATTLE WASHINGTON USA 98108
206.621.8400

Certificate of Analysis: E.P.A. Protocol Gas Mixture

Customer:	Bryne Specialty Gas	P.O.	SP-6063-68585
Cylinder No :	CC44489	Order No.	364140-00
Cylinder Pressure:	1900	Expiration Date:	5/16/99
Certification Date	5/24/96	Laboratory:	Los Angeles

Reference Standard Information:

Type	Component	Cyl. Number	Concentration
GMIS	Carbon Monoxide	300-178187	971.8 PPM
GMIS	Oxygen	CC21248	20 %
GMIS	Carbon Dioxide	T591121	14.01 %

Instrumentation:

Instrument/Model/Serial No.	Analytical Principle
Siemens/5e/BO2-777, BO2-776	NDIR
Beckman/755/1000242	Paramagnetic

Analytical Methodology does not require correction for analytical interferences.

Certified Concentrations:

Component	Concentration	Accuracy	Procedure
Carbon Monoxide	909 PPM	+/- 1%	G1
Oxygen	22.0 %	+/- 1%	G1
Carbon Dioxide	22.0 %	+/- 1%	G2
Nitrogen	Balance		

Analytical Results:

1st Component: Carbon Monoxide

1st Analysis Date:		5/16/96					
R	77.800	S	72.700	Z	0.000	Conc	908.096 PPM
S	72.700	Z	0.000	R	77.800	Conc	908.096 PPM
Z	0.000	R	77.800	S	72.700	Conc	908.096 PPM
						AVG:	908.096 PPM

2nd Analysis Date:		5/23/96					
R	77.800	S	72.800	Z	0.000	Conc	909.345 PPM
S	72.800	Z	0.000	R	77.900	Conc	908.178 PPM
Z	0.000	R	77.800	S	72.800	Conc	909.345 PPM
						AVG:	908.956 PPM

AGCS2M003371 S300786

SO-CAL Airgas

BYRNE SPECIALTY GASES
631 SOUTH ANDOVER STREET • SEATTLE WASHINGTON USA 98108
206.621.8400

2nd Component: Oxygen

1st Analysis Date:		5/16/96						
R	90.000	S	99.000	Z	0.000	Conc	22.000	%
S	99.000	Z	0.000	R	90.000	Conc	22.000	%
Z	0.000	R	90.000	S	99.000	Conc	22.000	%
						AVG:	22.000	%
2nd Analysis Date:								
R		S		Z		Conc	0.000	%
S		Z		R		Conc	0.000	%
Z		R		S		Conc	0.000	%
						AVG:	0.000	%

3rd Component: Carbon Dioxide

1st Analysis Date:		5/16/96						
R	50.900	S	80.100	Z	0.000	Conc	22.047	%
S	80.100	Z	0.000	R	50.900	Conc	22.047	%
Z	0.000	R	50.900	S	80.100	Conc	22.047	%
						AVG:	22.047	%
2nd Analysis Date:								
R		S		Z		Conc	0.000	%
S		Z		R		Conc	0.000	%
Z		R		S		Conc	0.000	%
						AVG:	0.000	%

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1993)" using the assay procedures listed.

Do not use cylinder below 150 psig.

Approved for Release

AGCS2M003372 S300787